APPENDIX THREE

Spectra Relevant to Chapter Five: Further Investigations into Palladium(II)-Catalyzed Asymmetric Oxidative Heterocyclizations

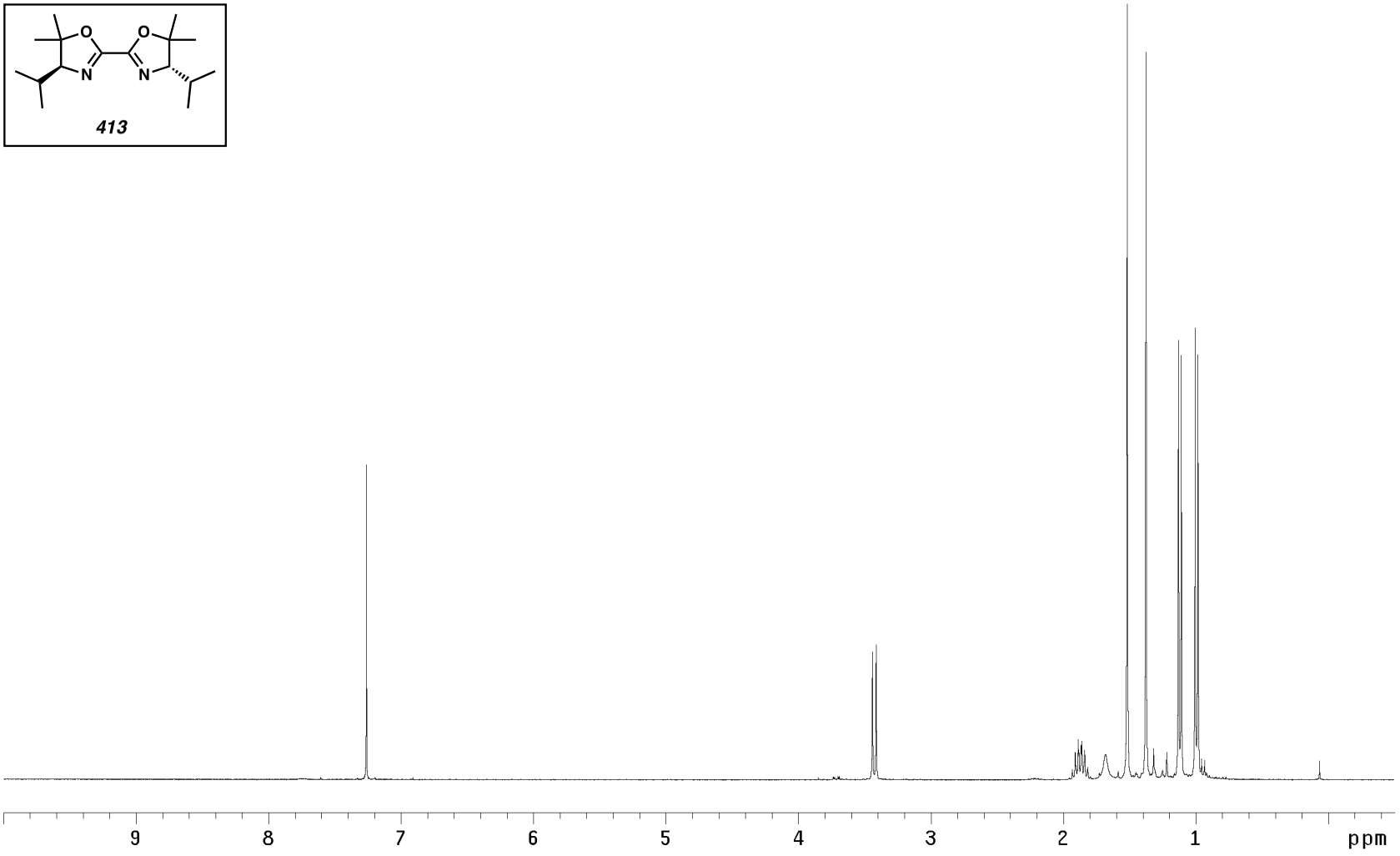


Figure A3.1 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **413**.

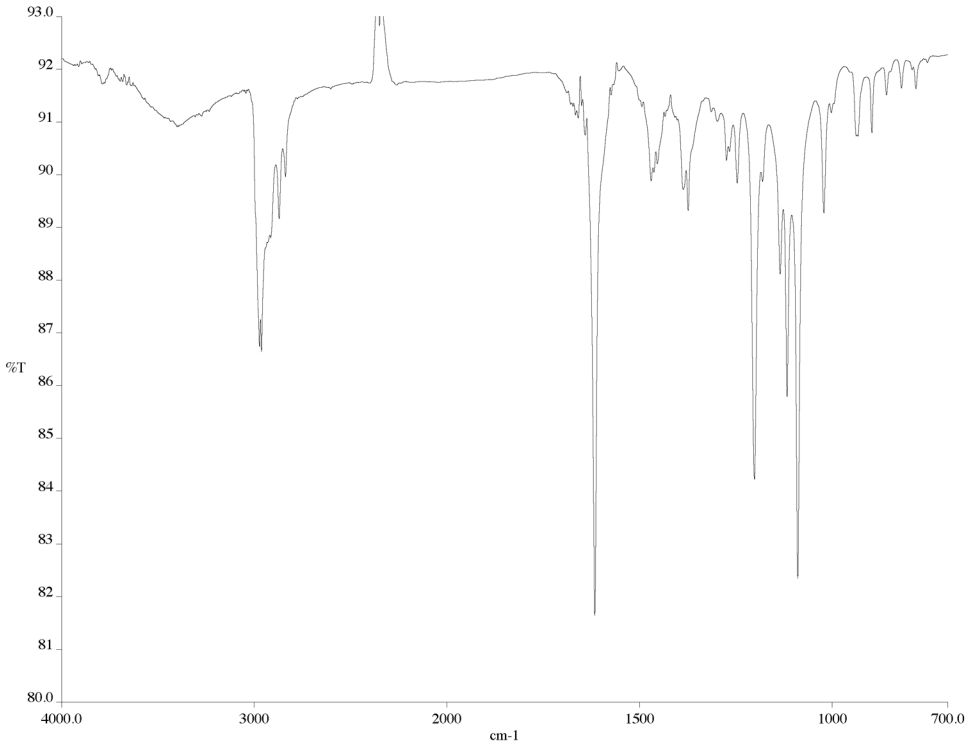


Figure A3.2 Infrared spectrum (thin film/NaCl) of compound **413**.

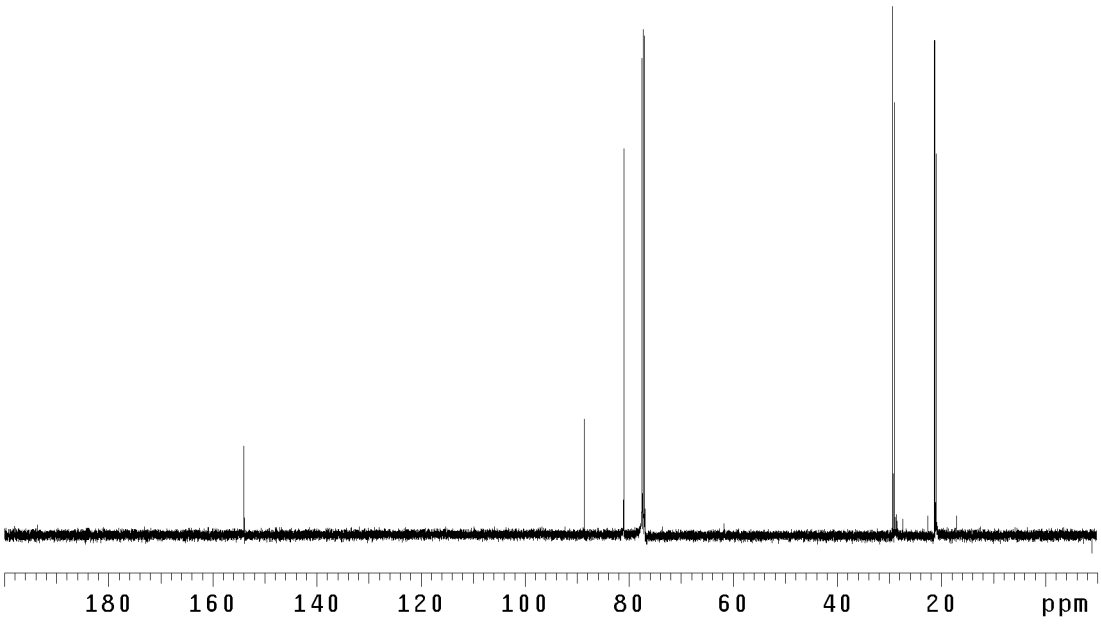


Figure A3.3 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **413**.

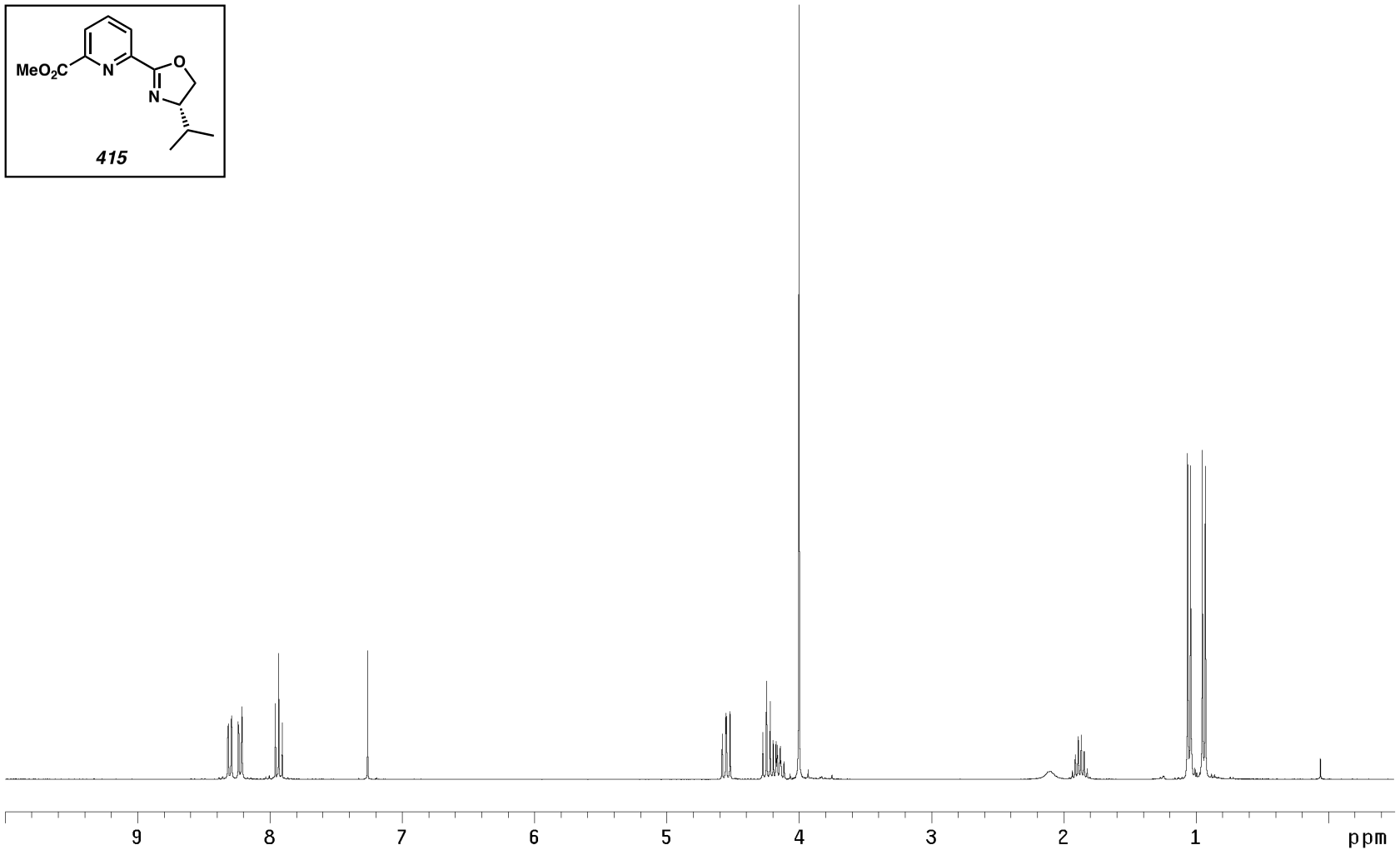


Figure A3.4 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **415**.

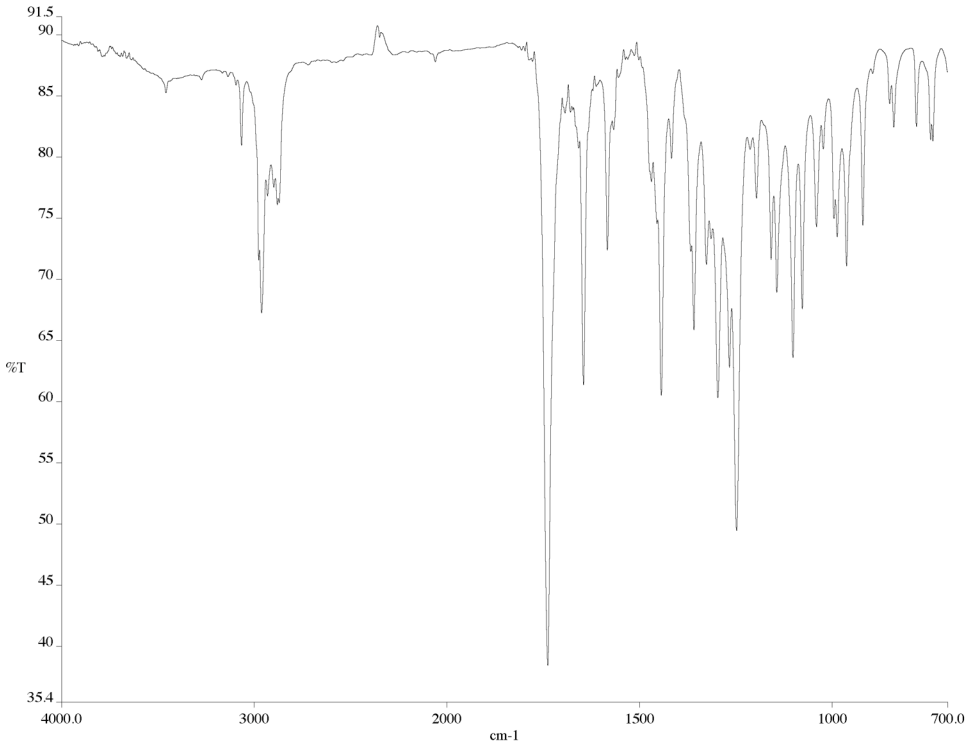


Figure A3.5 Infrared spectrum (thin film/NaCl) of compound **415**.

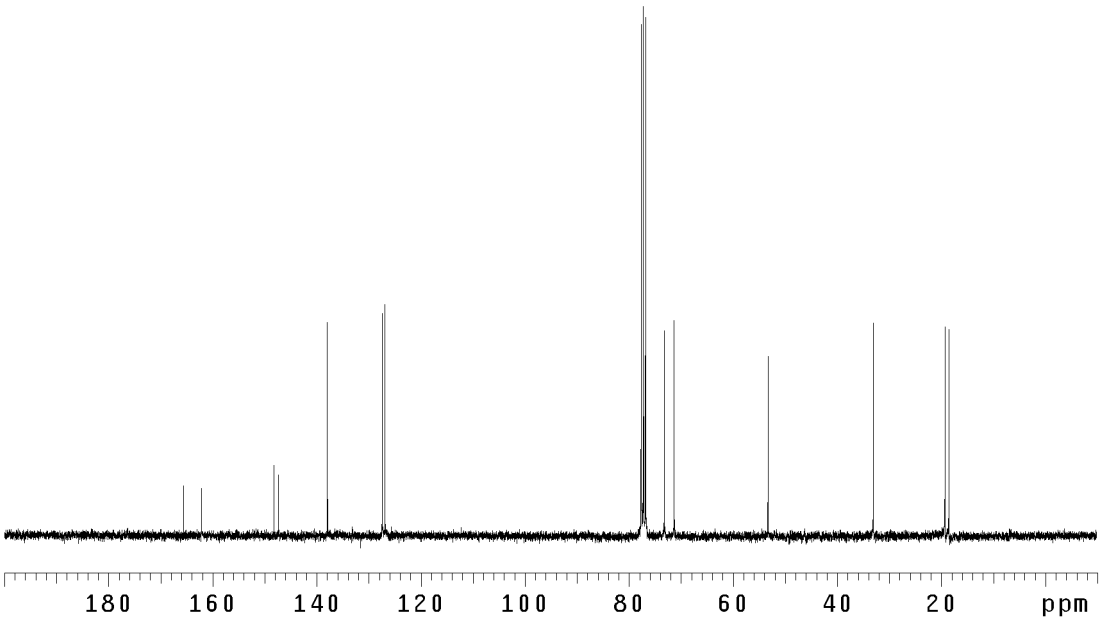


Figure A3.6 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **415**.

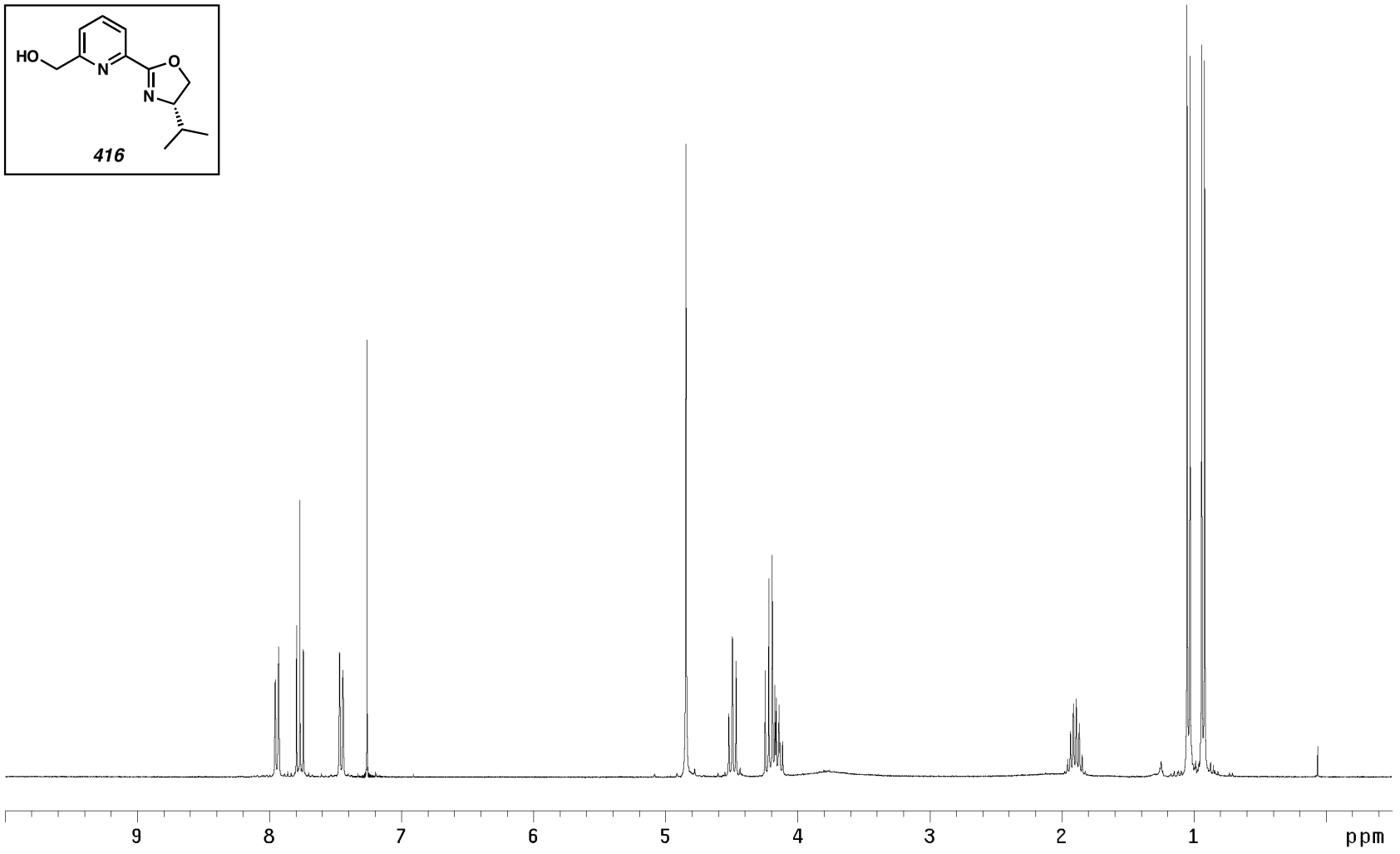


Figure A3.7 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **416**.

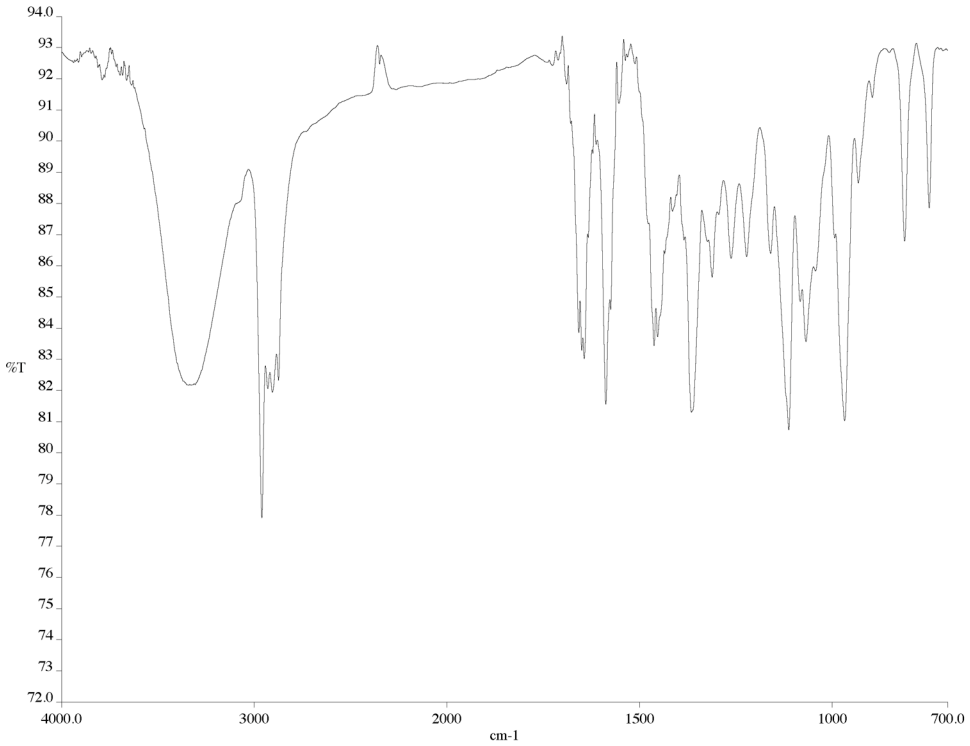


Figure A3.8 Infrared spectrum (thin film/NaCl) of compound **416**.

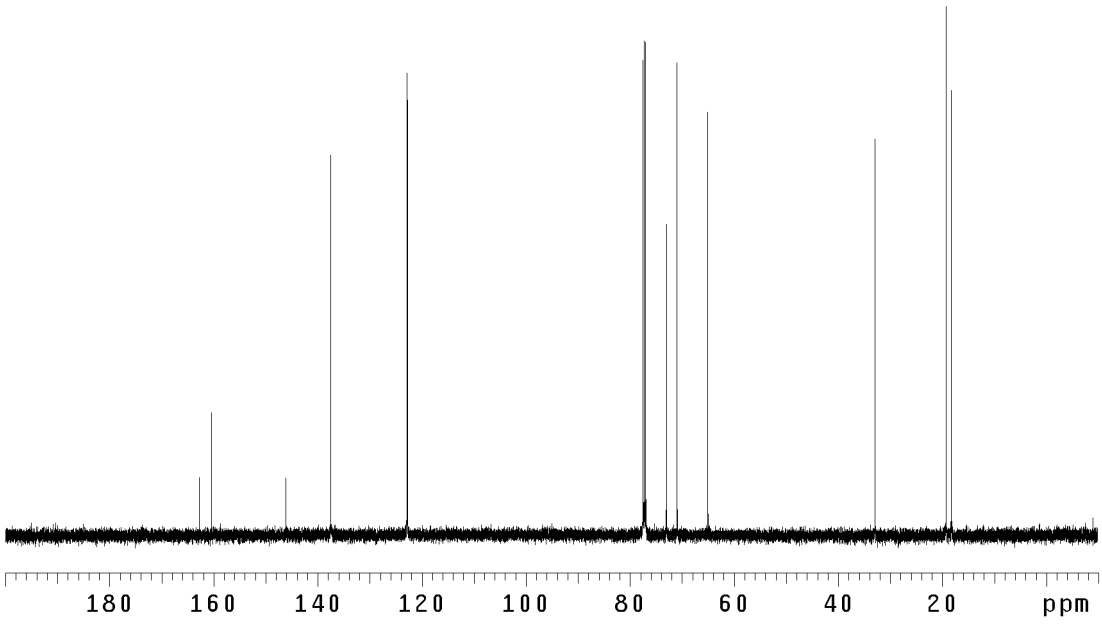


Figure A3.9 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **416**.

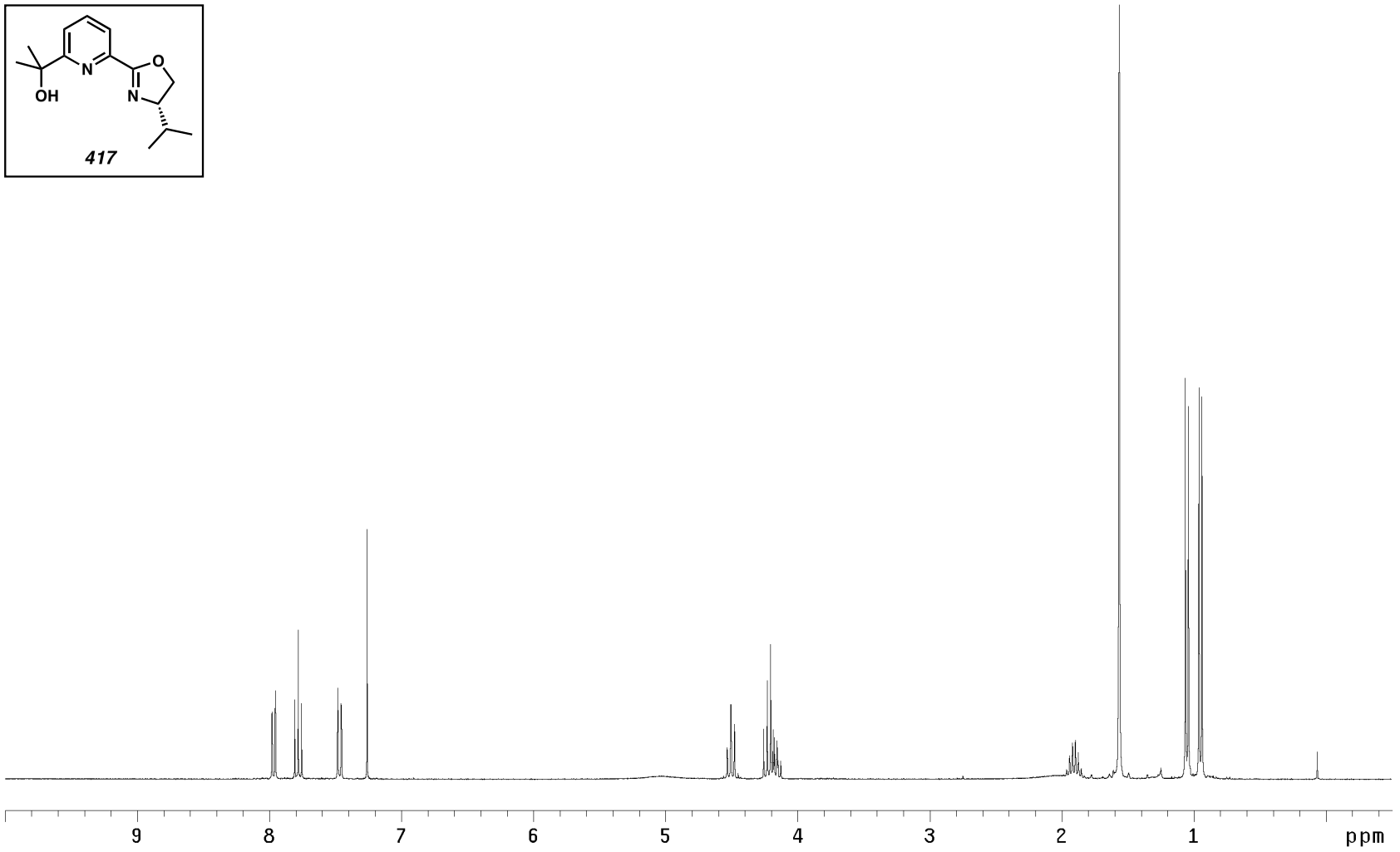


Figure A3.10 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **417**.

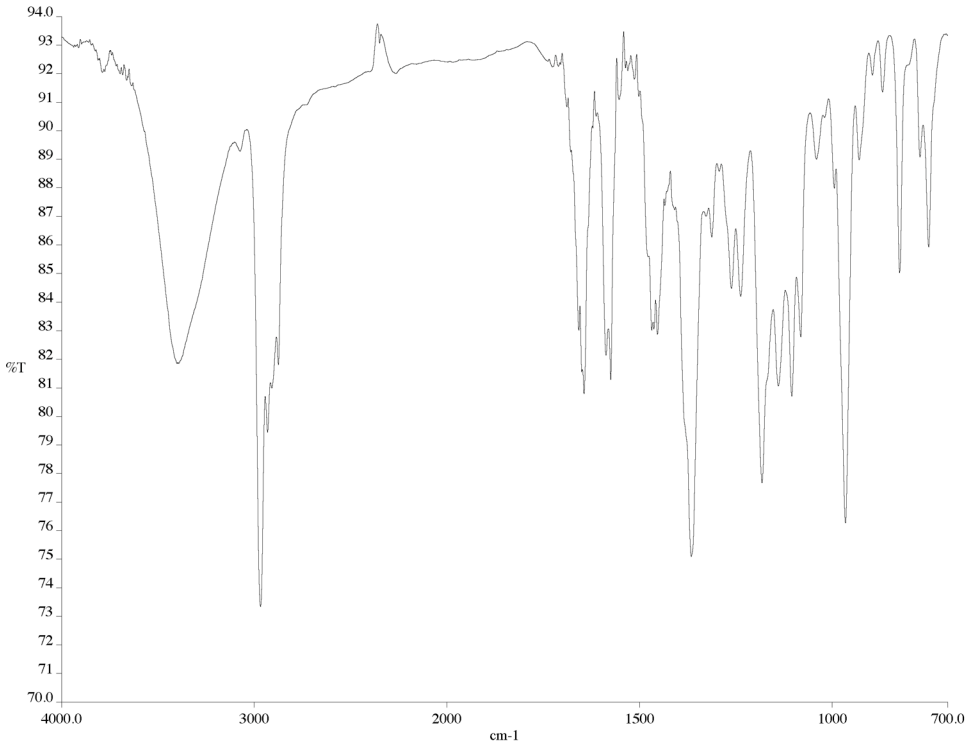


Figure A3.11 Infrared spectrum (thin film/NaCl) of compound **417**.

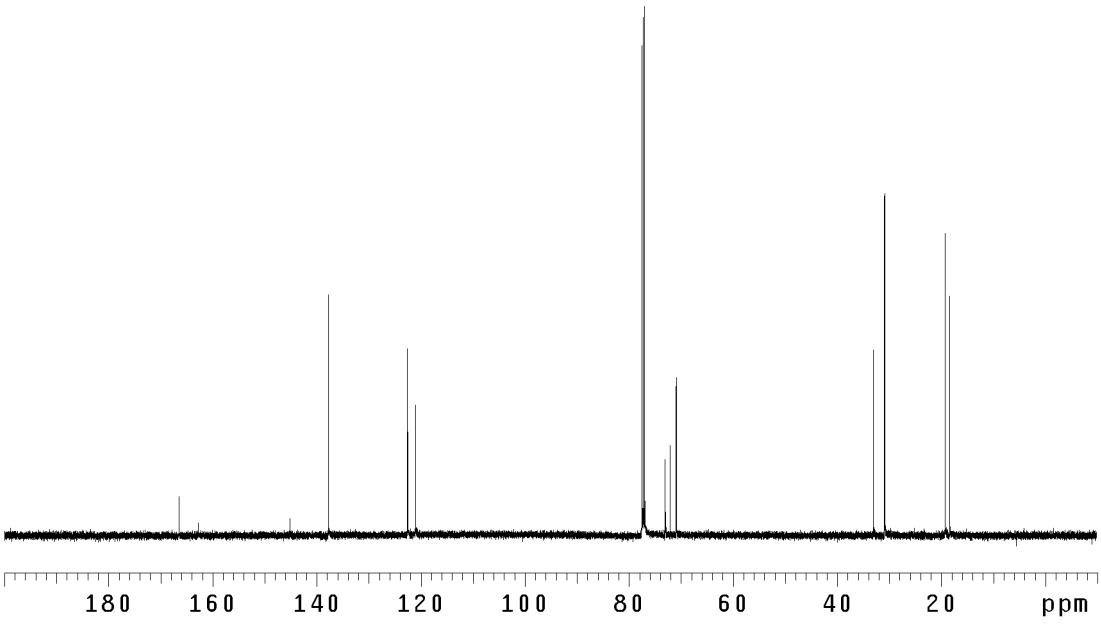


Figure A3.12 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **417**.

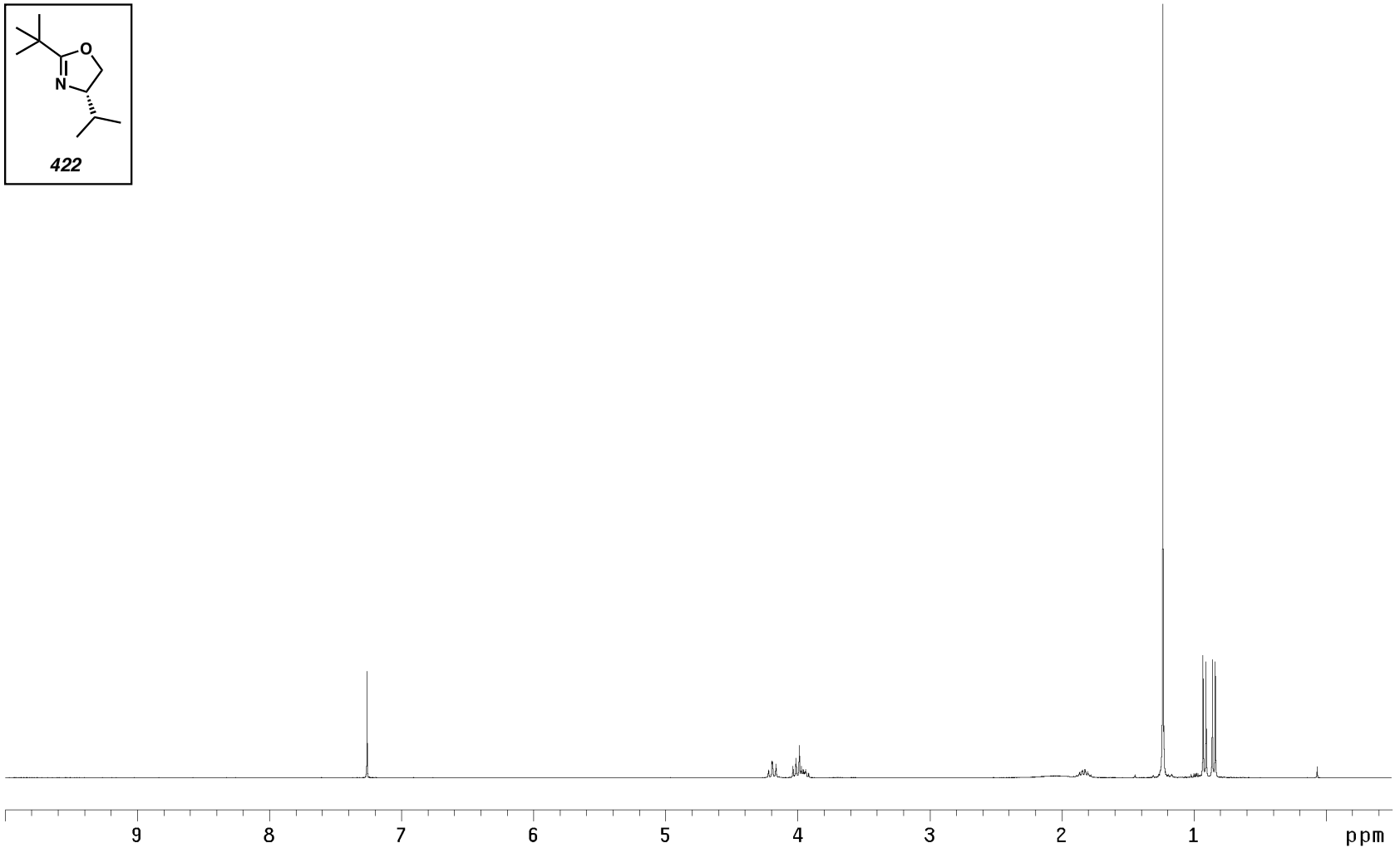


Figure A3.13 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **422**.

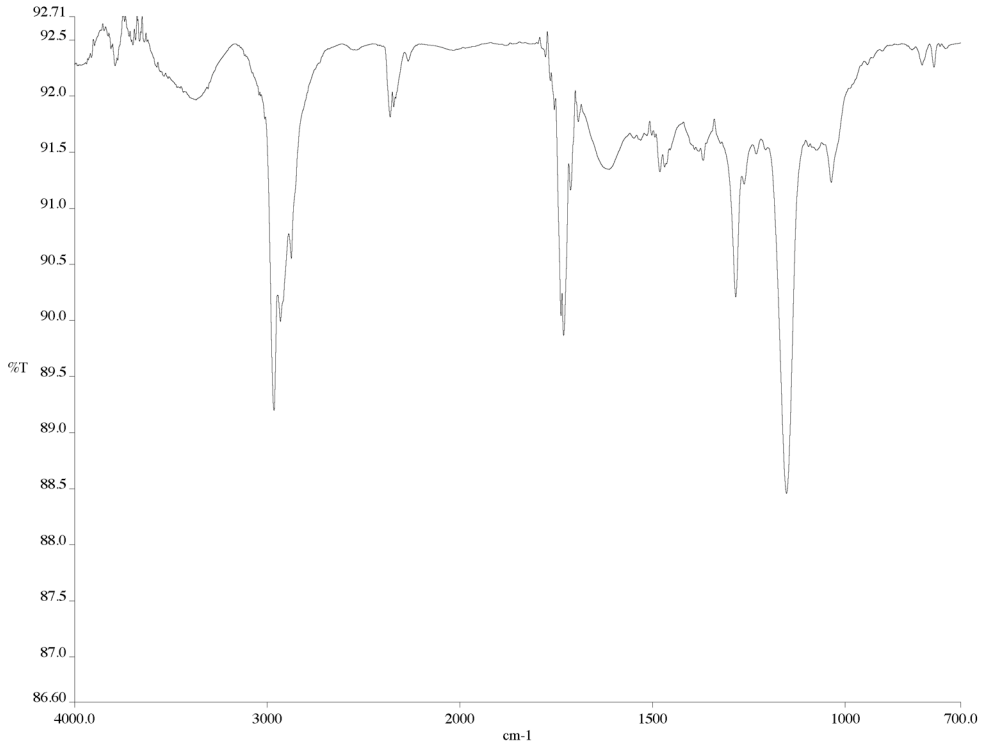


Figure A3.14 Infrared spectrum (thin film/NaCl) of compound **422**.

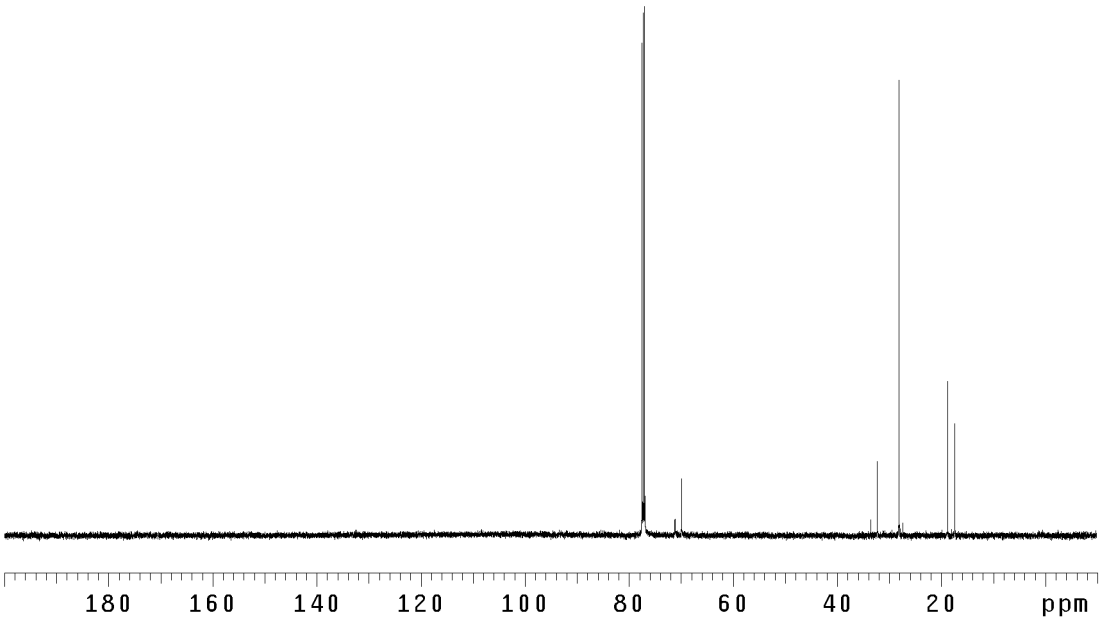


Figure A3.15 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **422**.

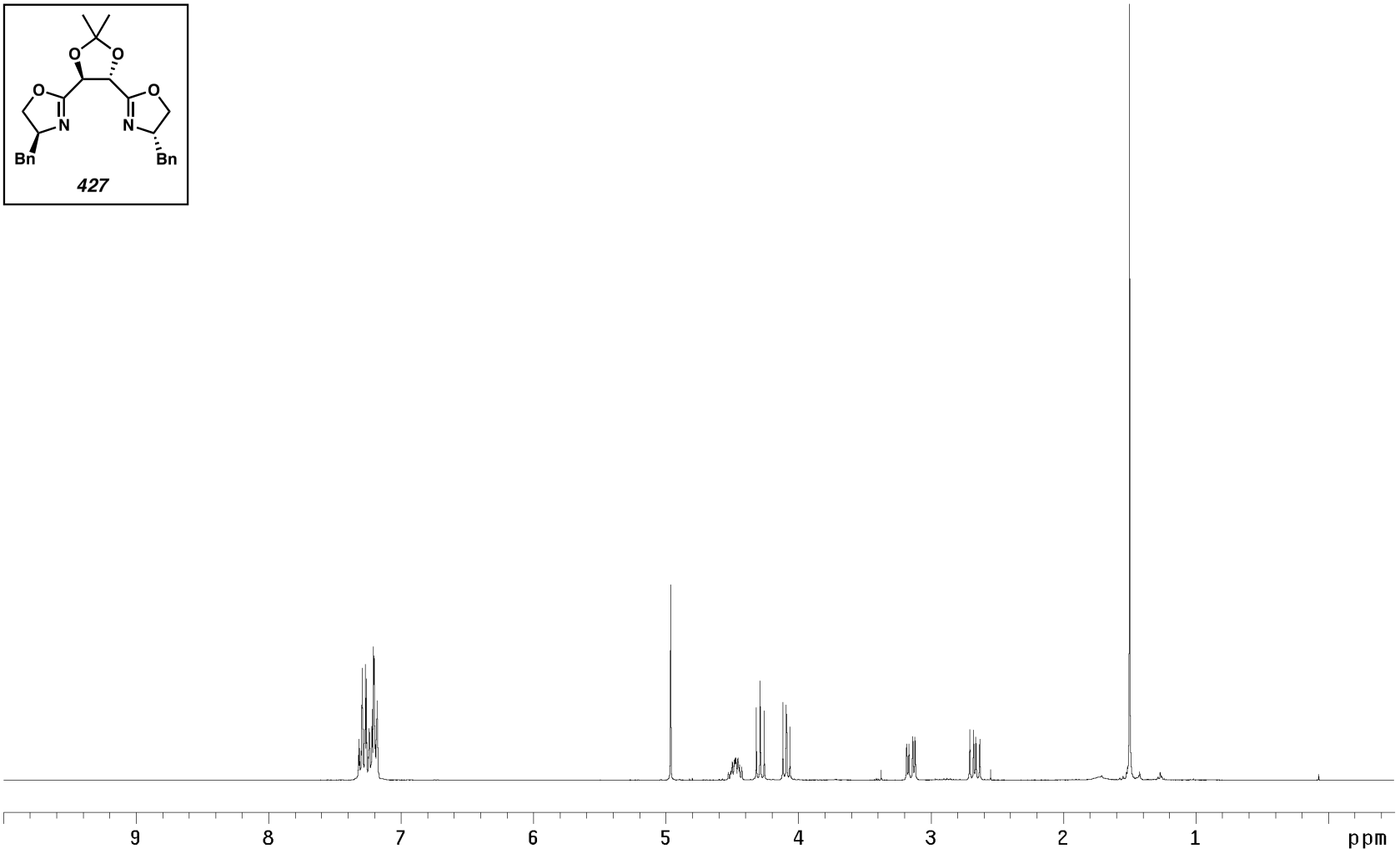


Figure A3.16 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **427**.

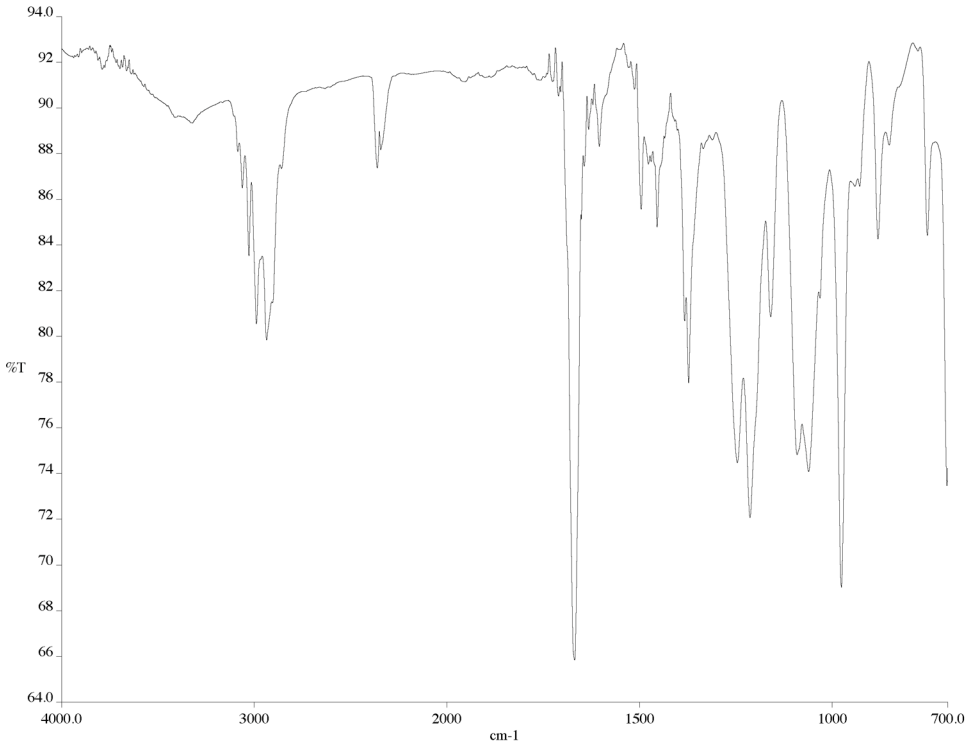


Figure A3.17 Infrared spectrum (thin film/NaCl) of compound **427**.

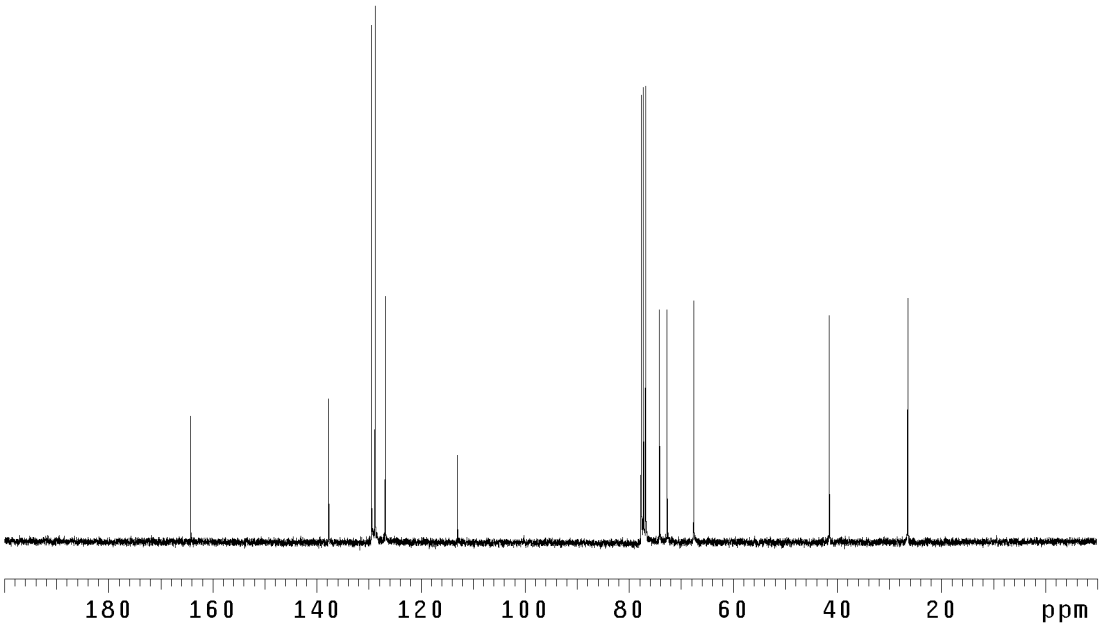


Figure A3.18 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **427**.

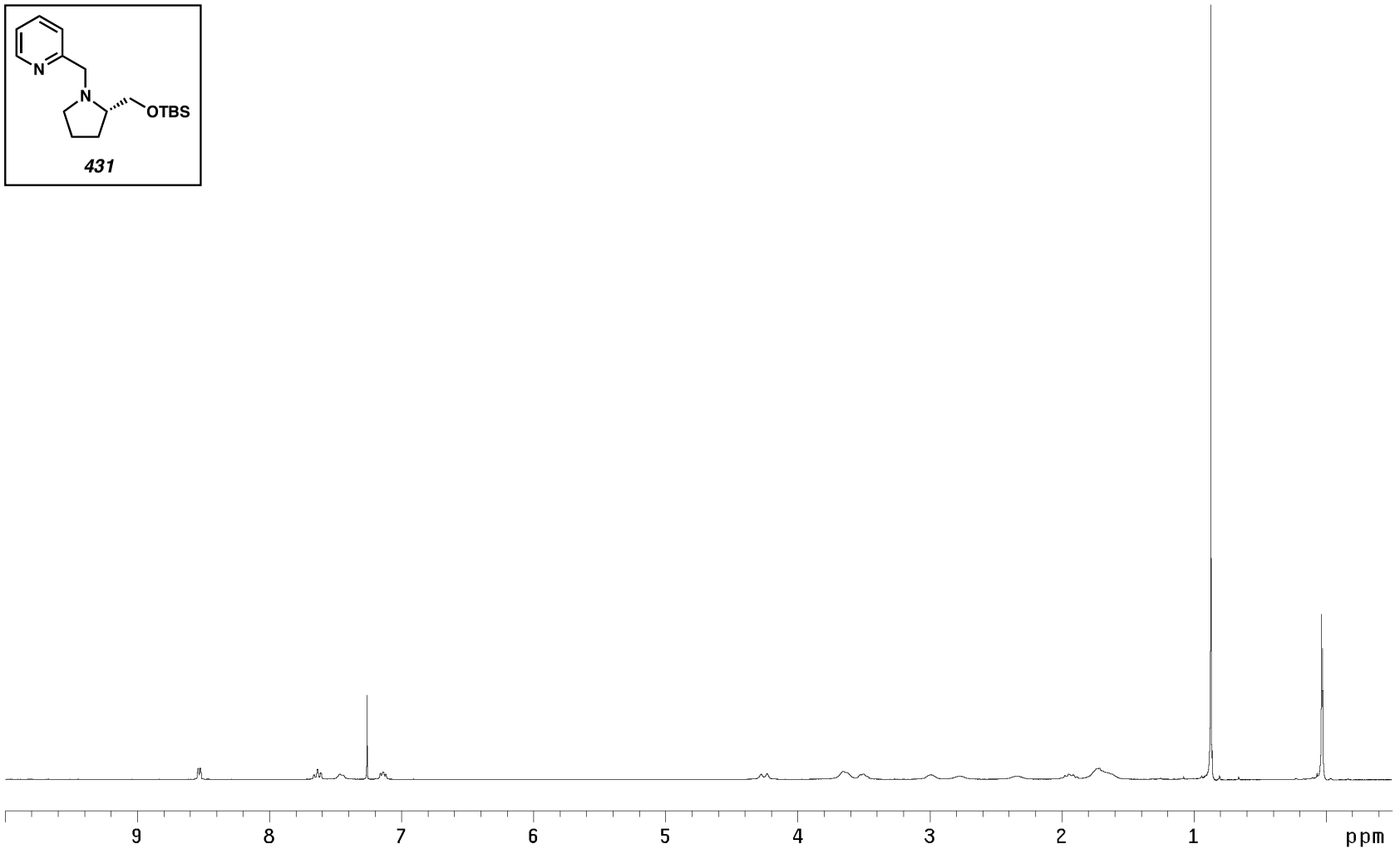


Figure A3.19 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **431**.

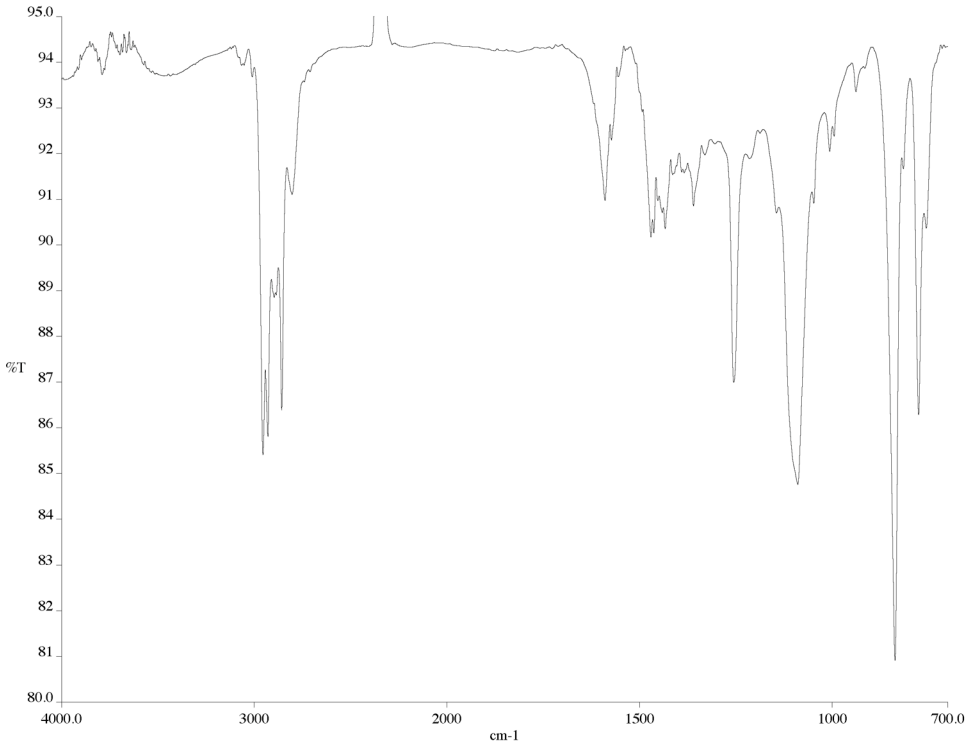


Figure A3.20 Infrared spectrum (thin film/NaCl) of compound **431**.

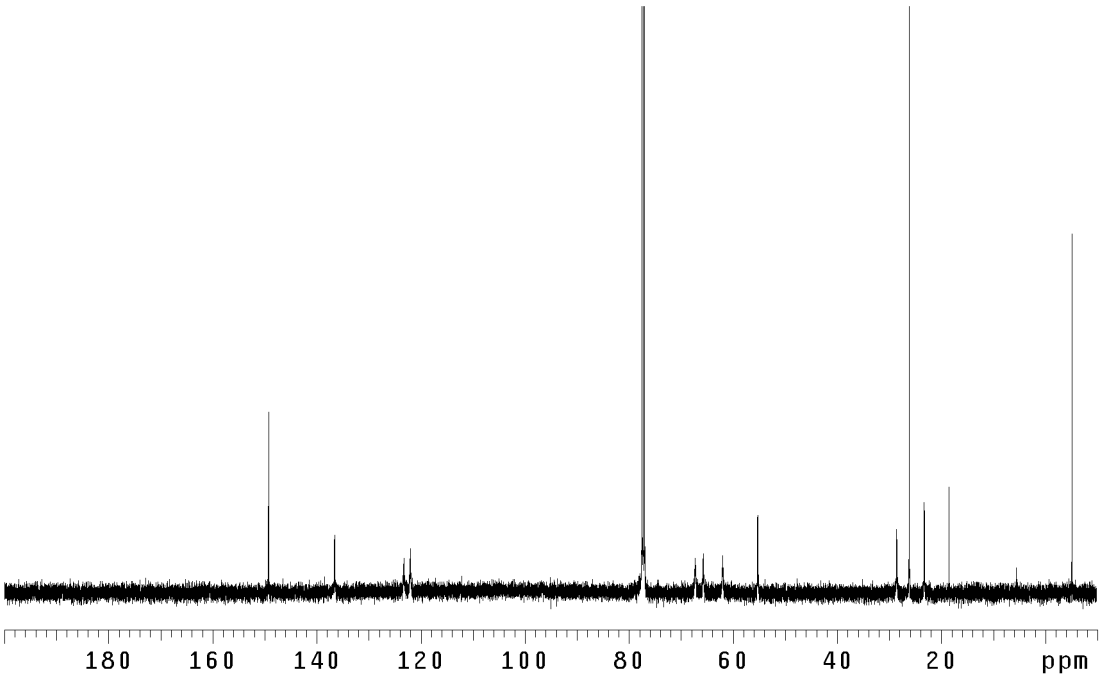


Figure A3.21 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **431**.

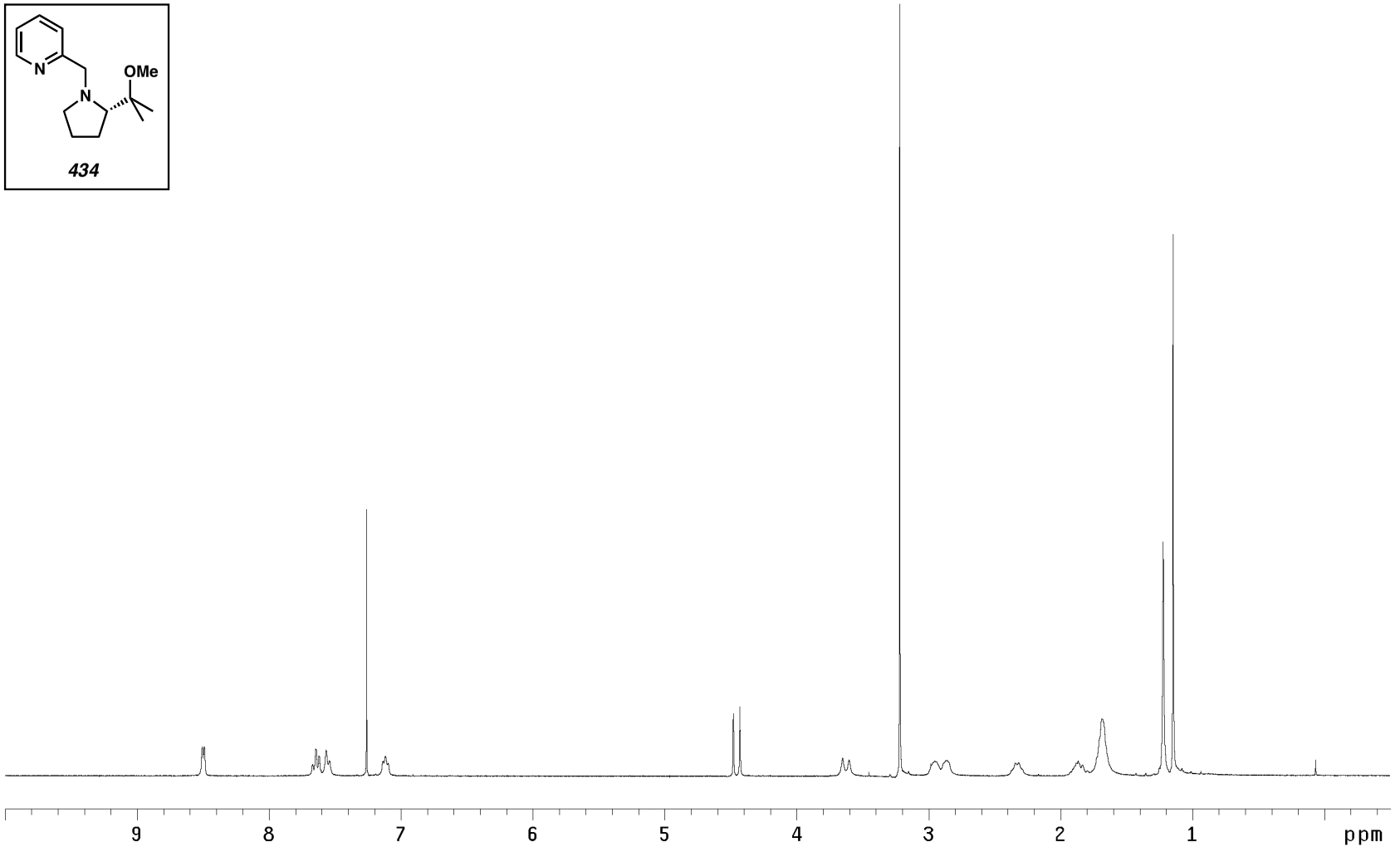


Figure A3.22 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **434**.

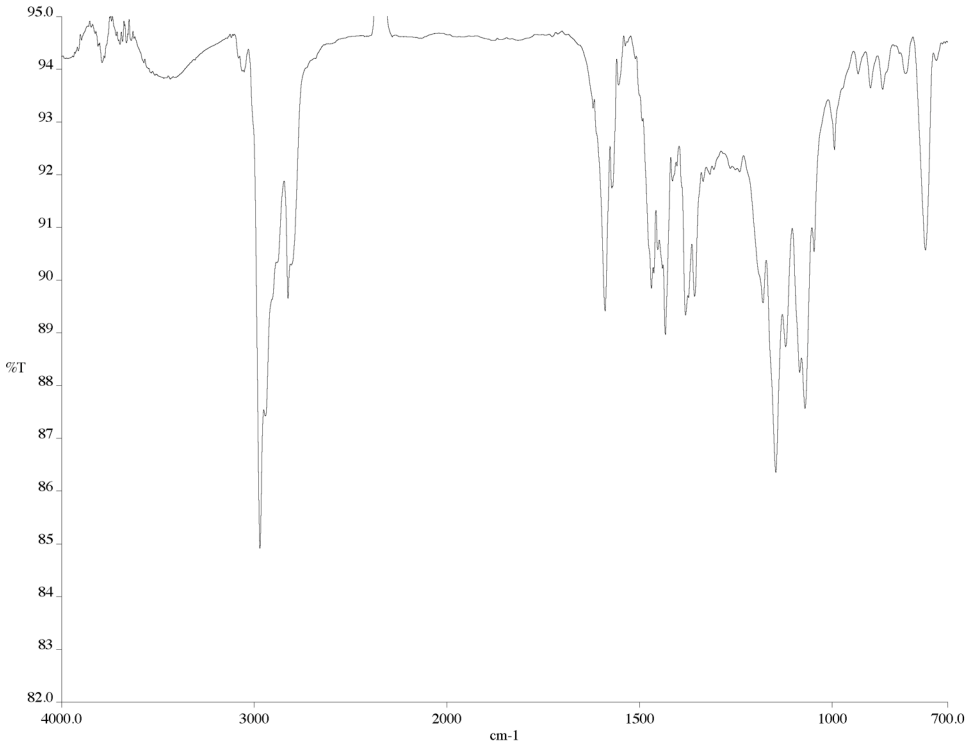


Figure A3.23 Infrared spectrum (thin film/NaCl) of compound **434**.

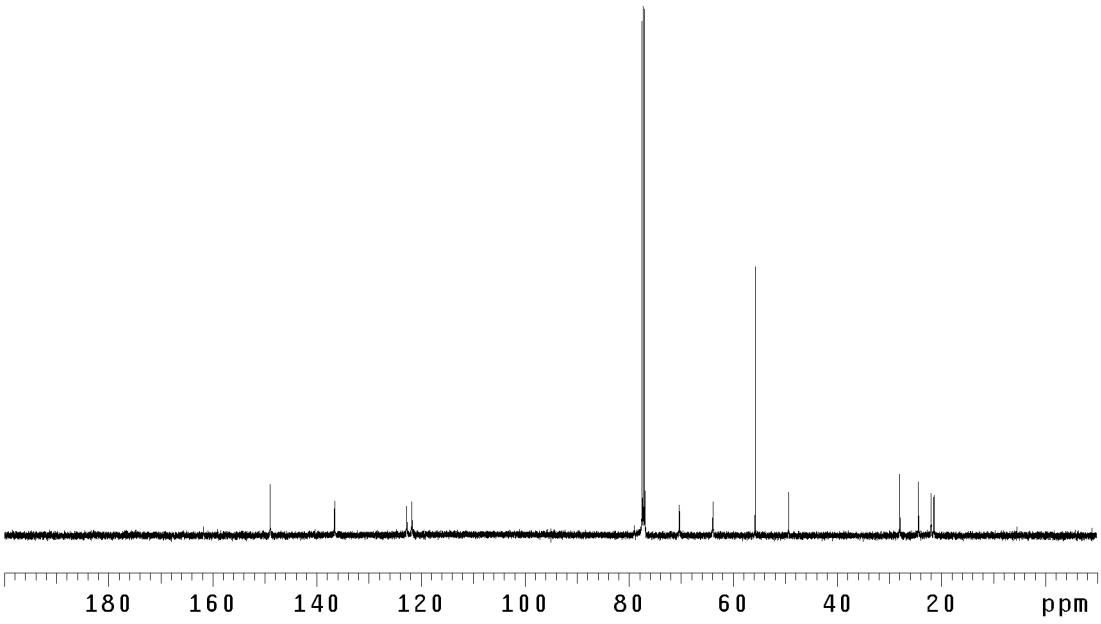


Figure A3.24 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **434**.

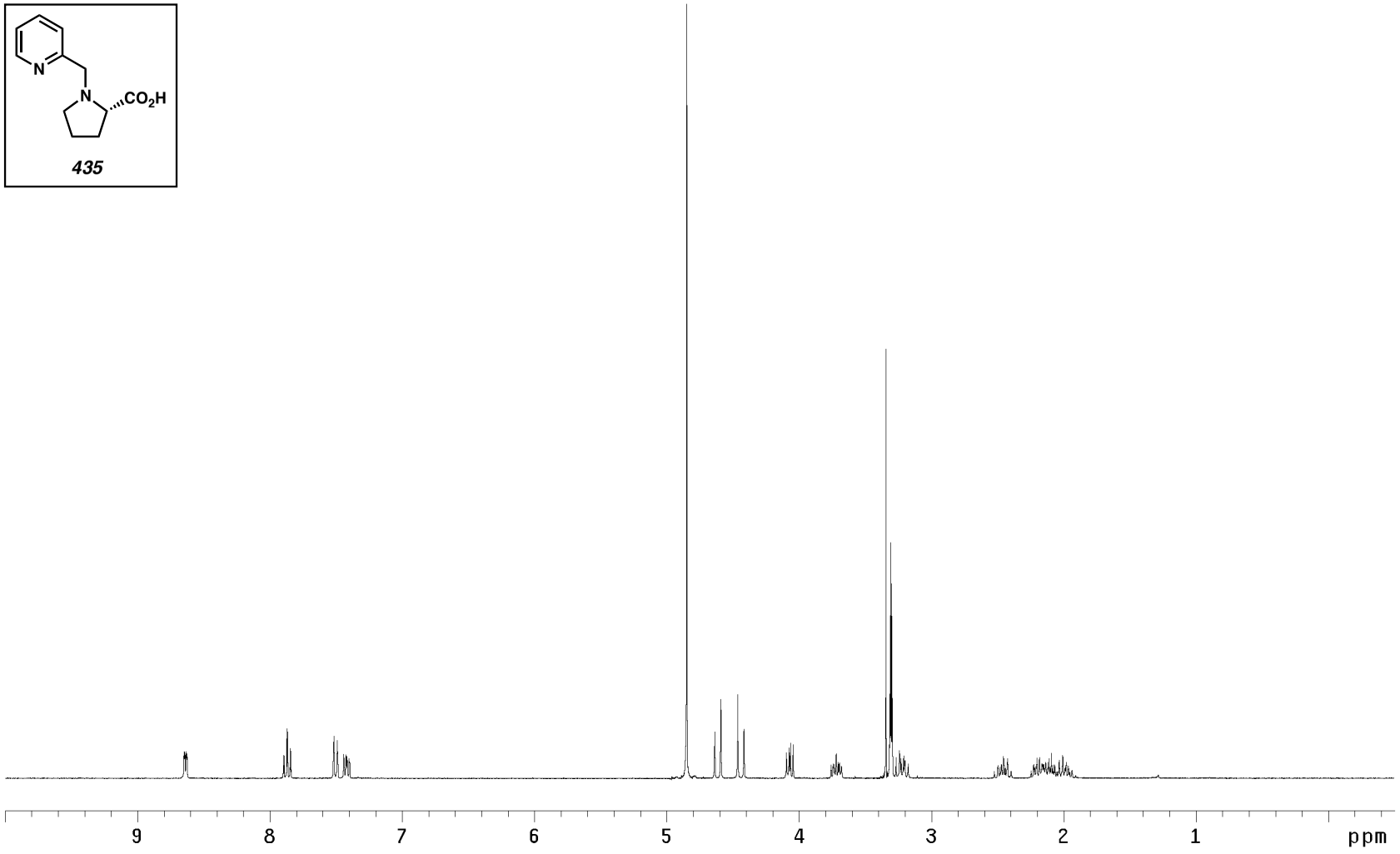


Figure A3.25 ^{1}H NMR (300 MHz, CD_3OD) of compound **435**.

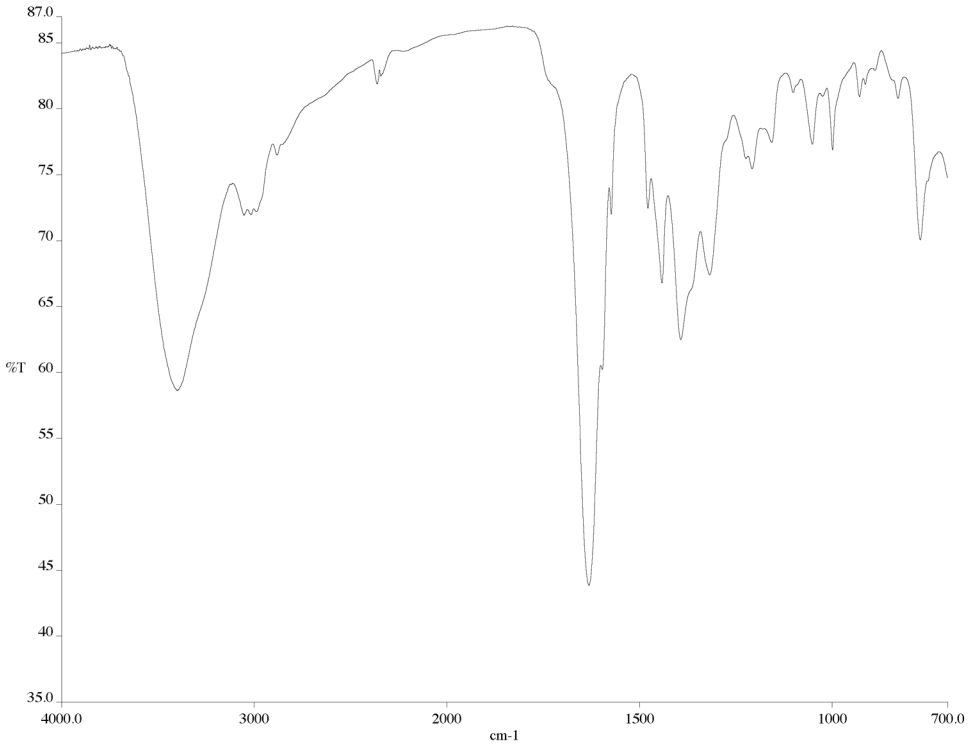


Figure A3.26 Infrared spectrum (thin film/NaCl) of compound **435**.

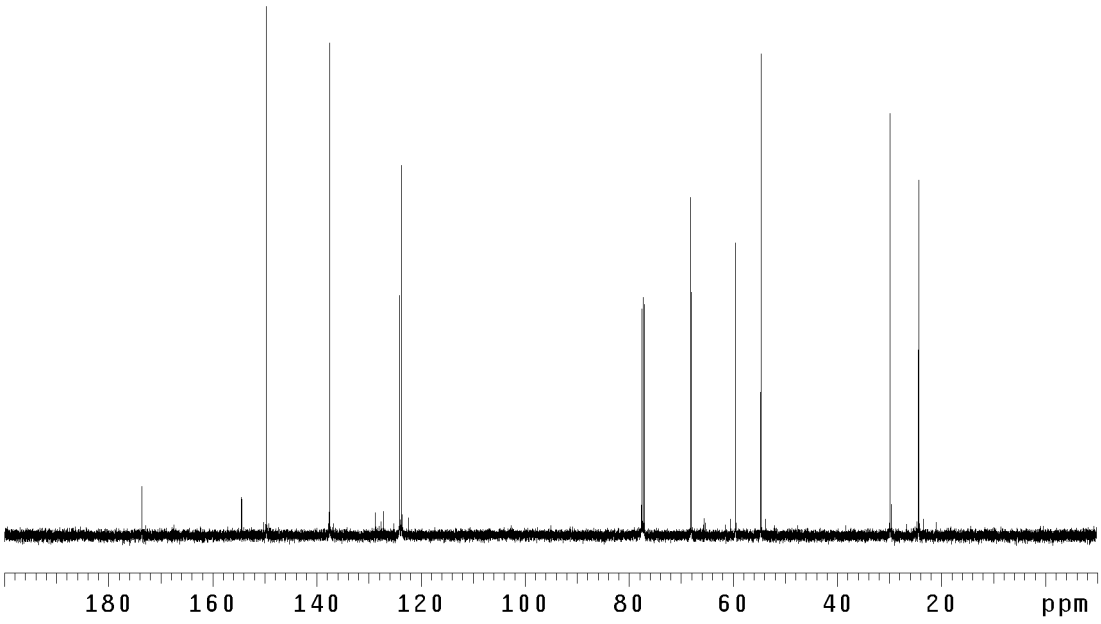


Figure A3.27 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **435**.

480

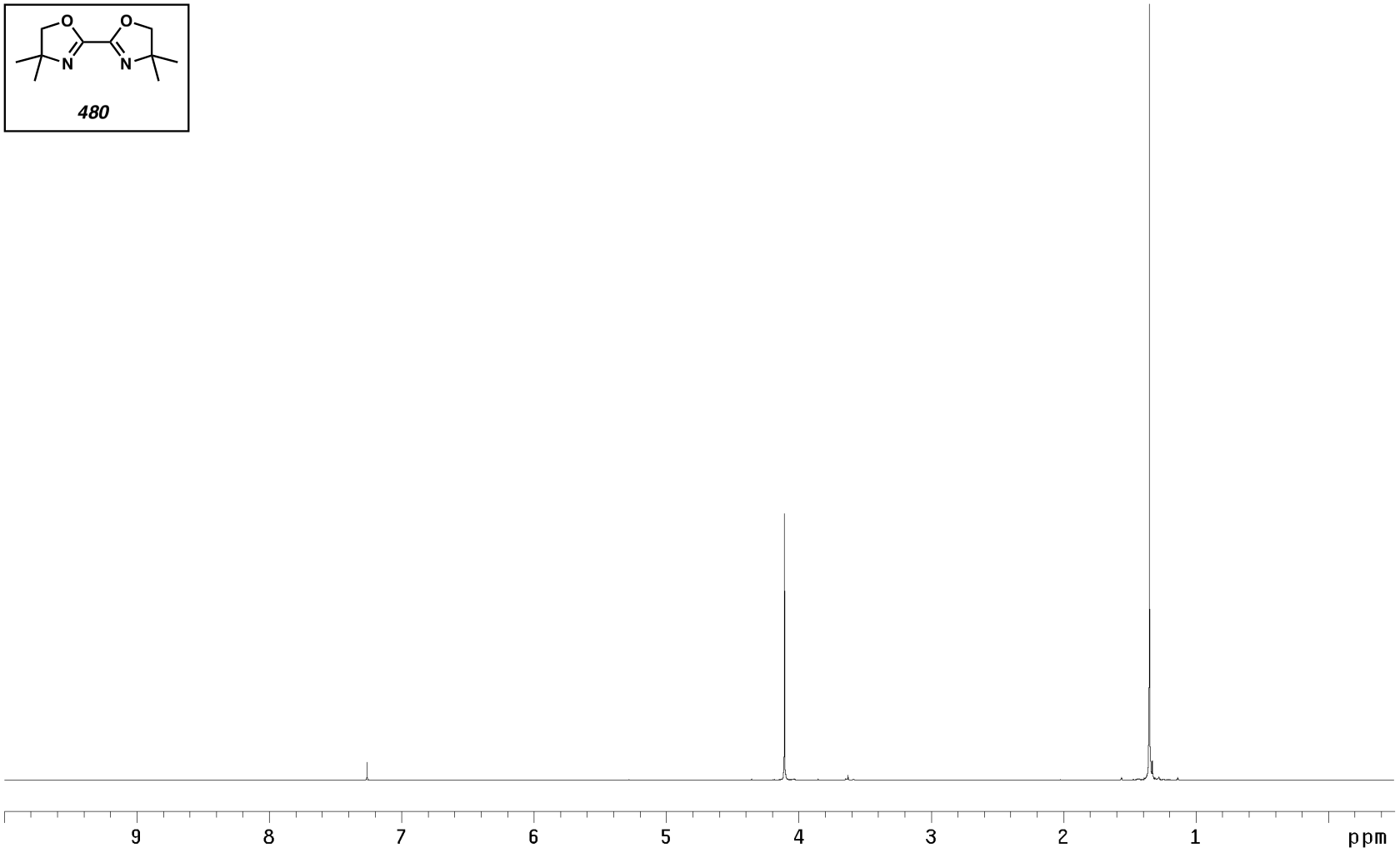


Figure A3.28 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **480**.

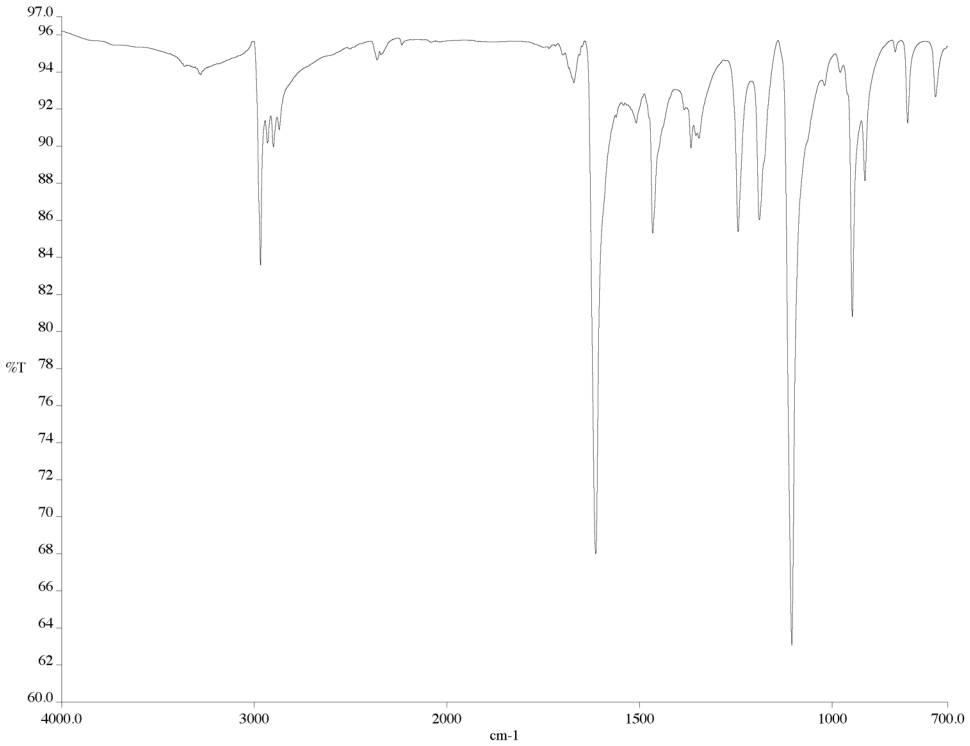


Figure A3.29 Infrared spectrum (thin film/NaCl) of compound **480**.

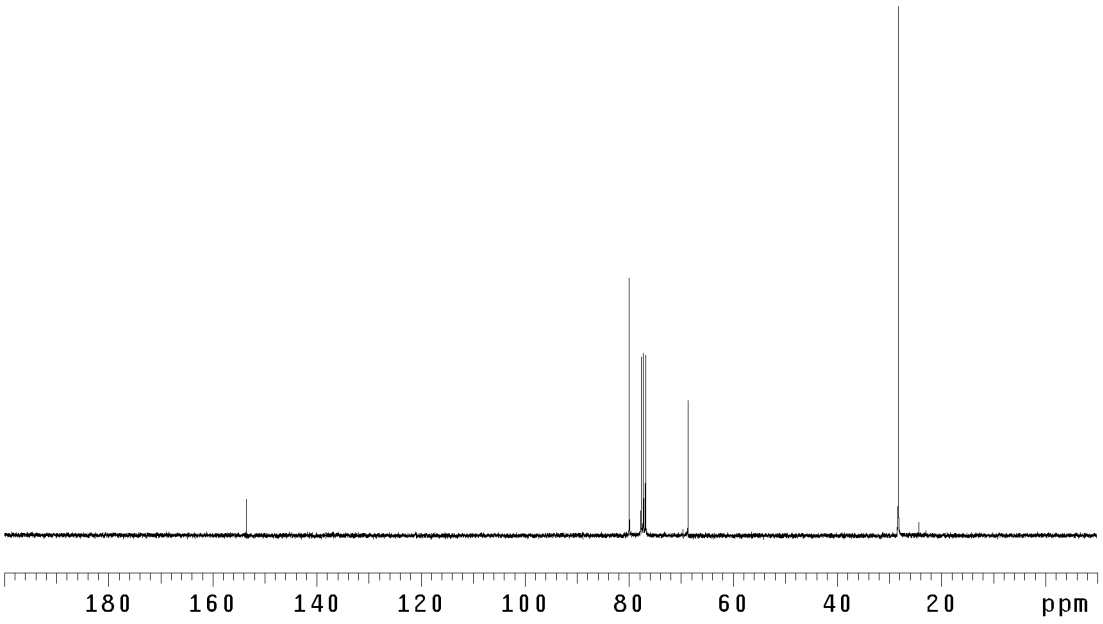


Figure A3.30 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **480**.

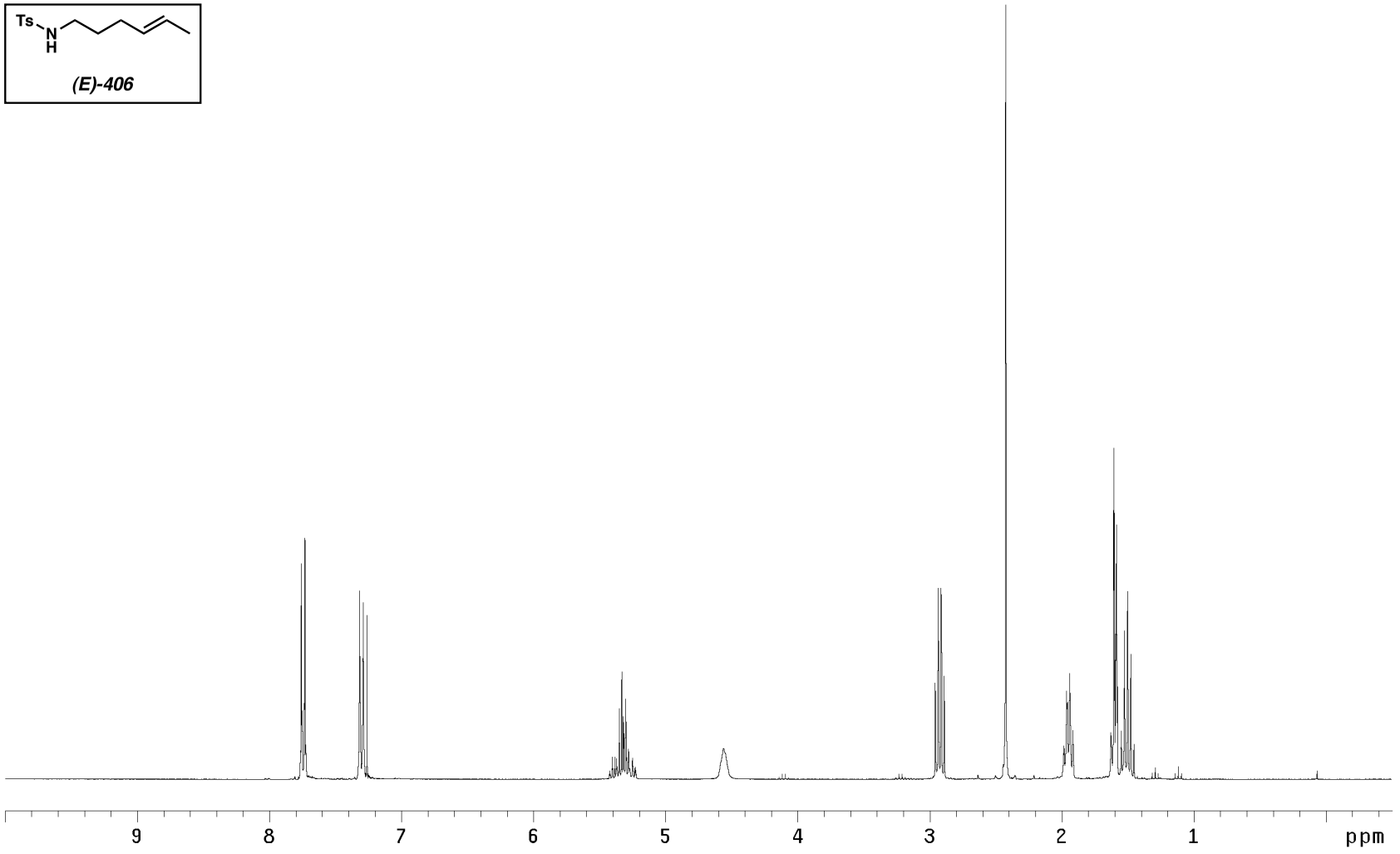


Figure A3.31 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **(*E*)-406**.

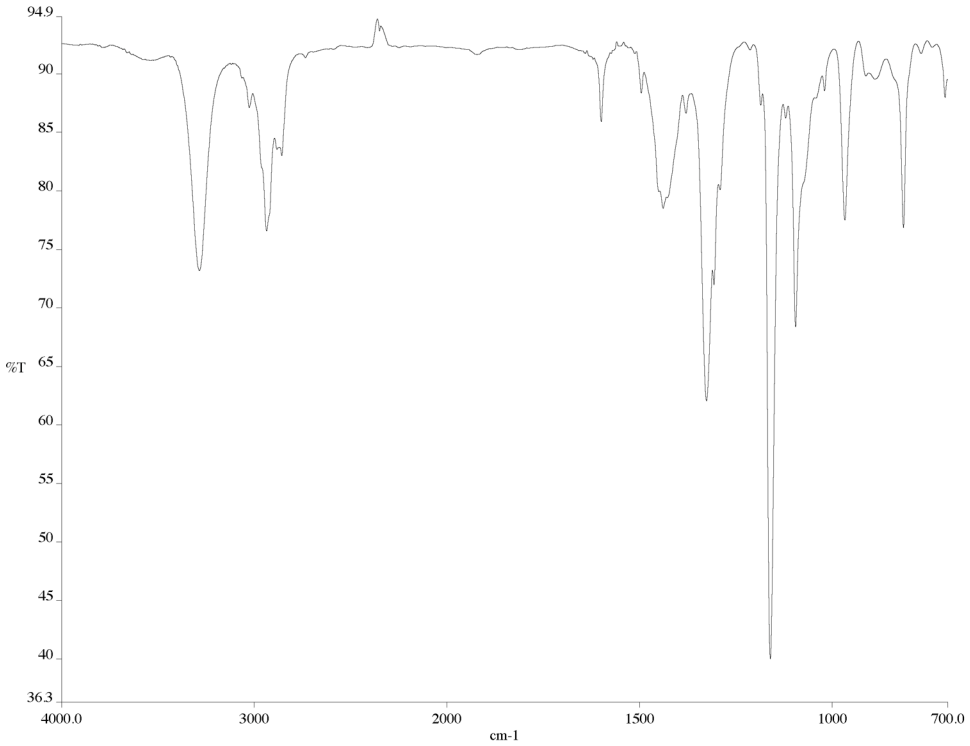


Figure A3.32 Infrared spectrum (thin film/NaCl) of compound **(*E*)-406**.

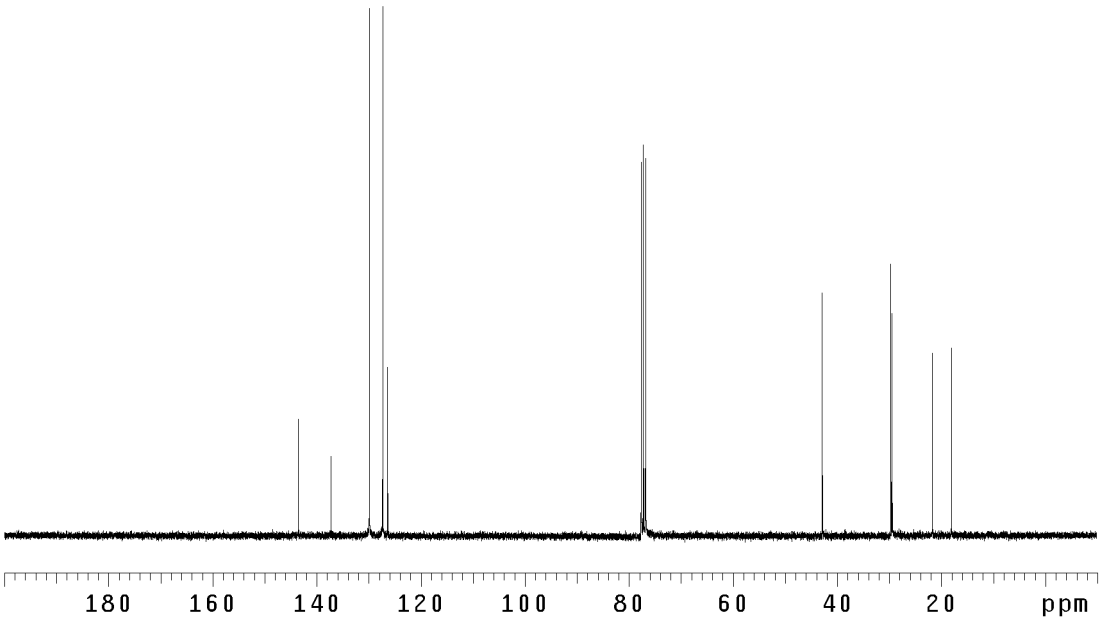


Figure A3.33 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **(*E*)-406**.

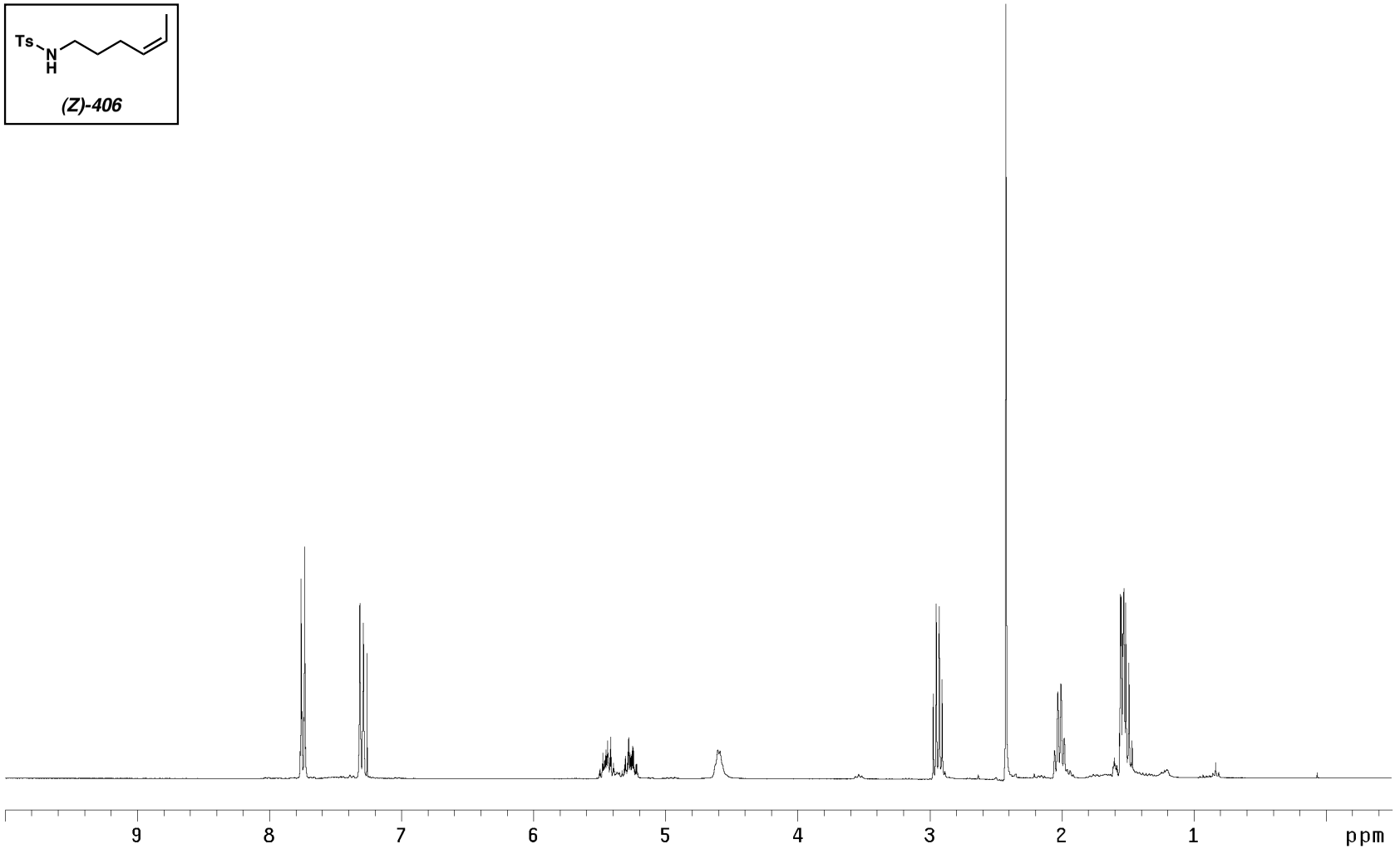


Figure A3.34 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **(*Z*)-406**.

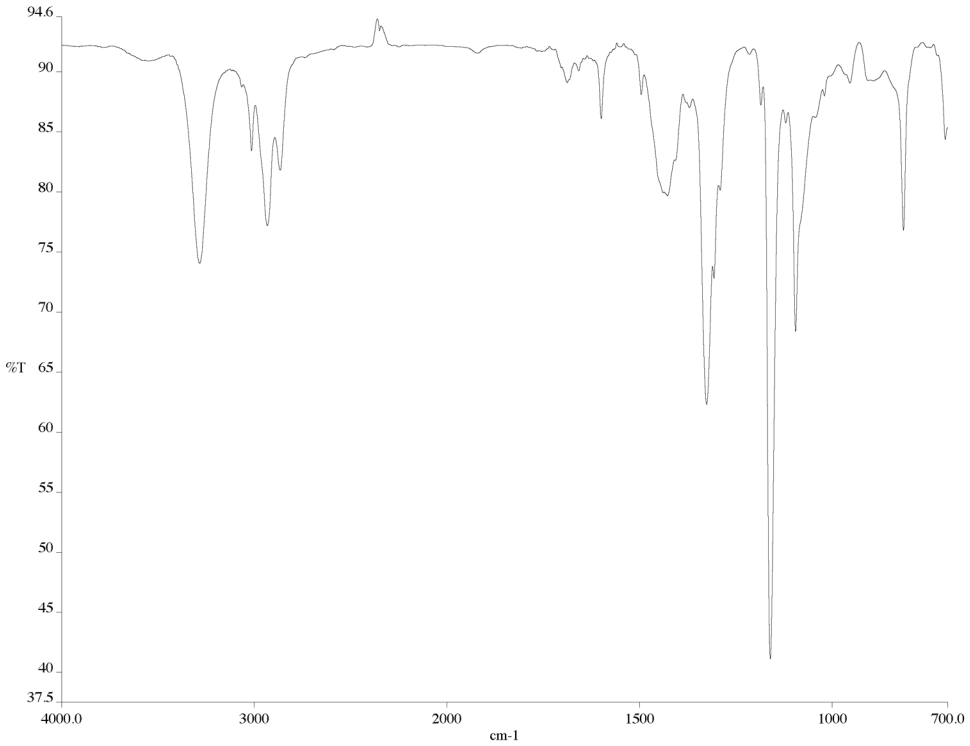


Figure A3.35 Infrared spectrum (thin film/NaCl) of compound **(*Z*)-406**.

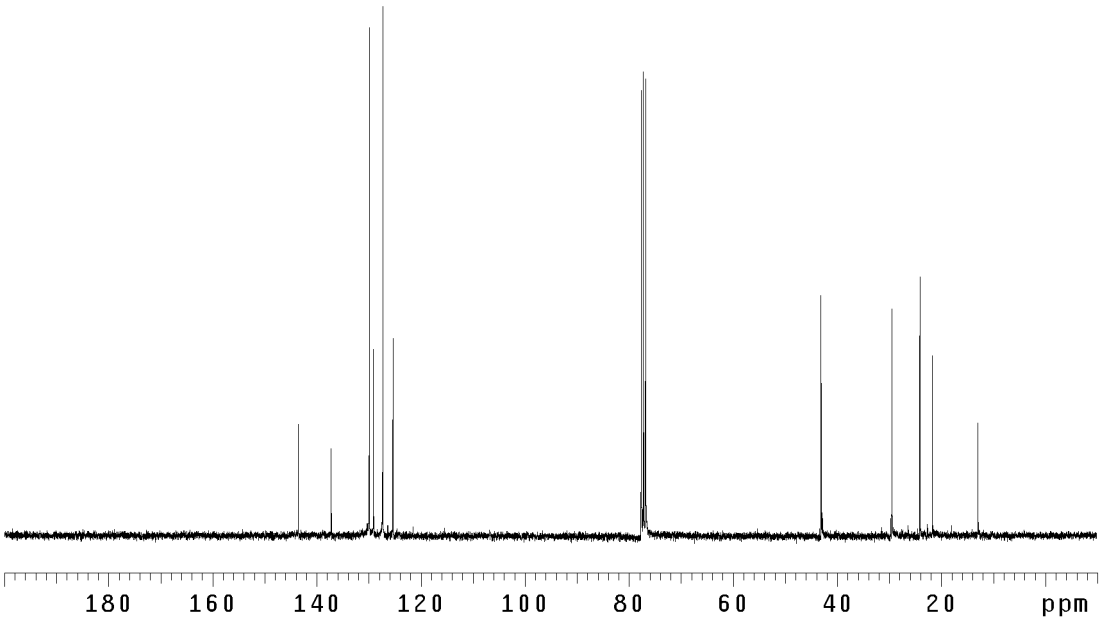


Figure A3.36 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **(*Z*)-406**.

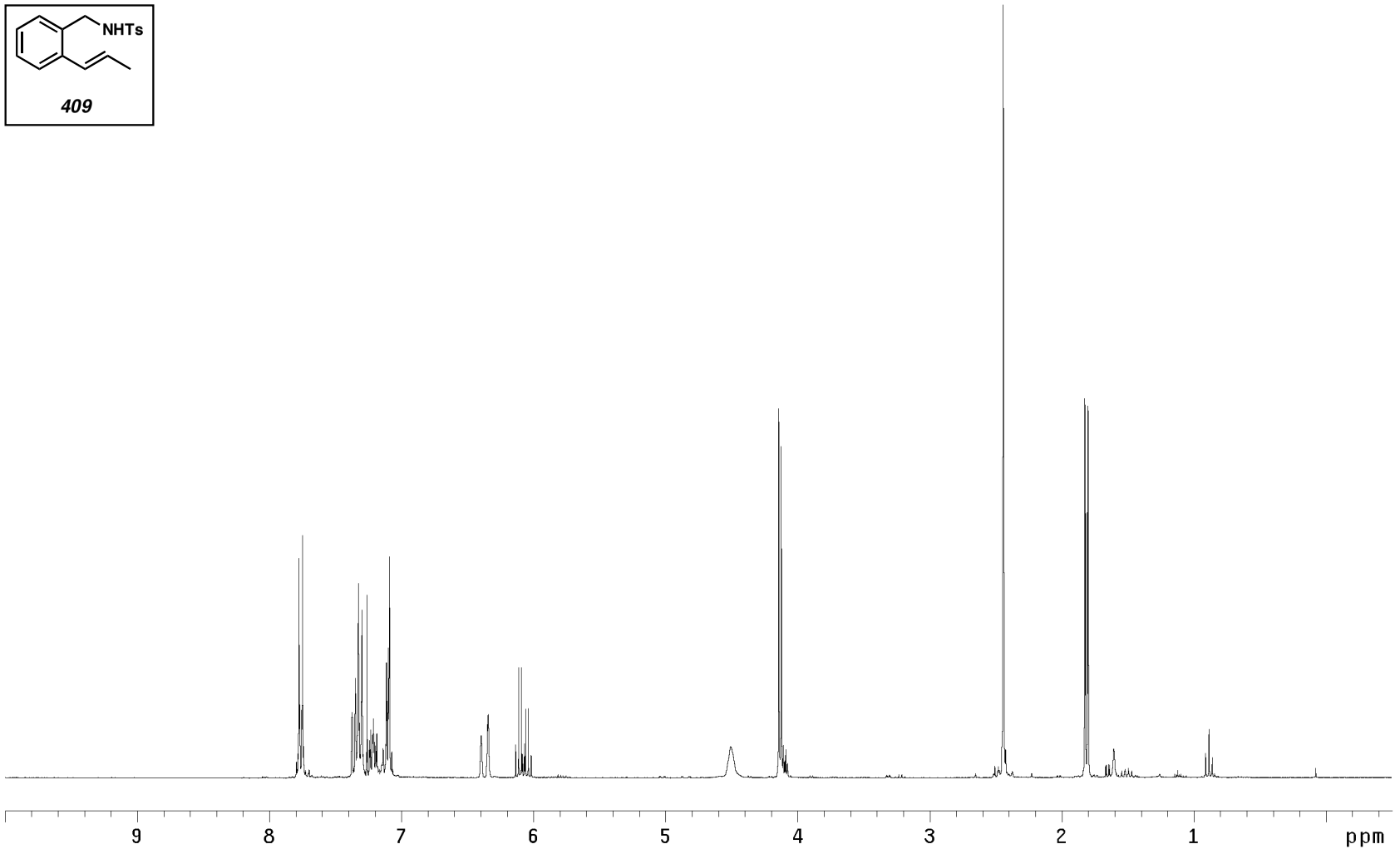


Figure A3.37 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **409**.

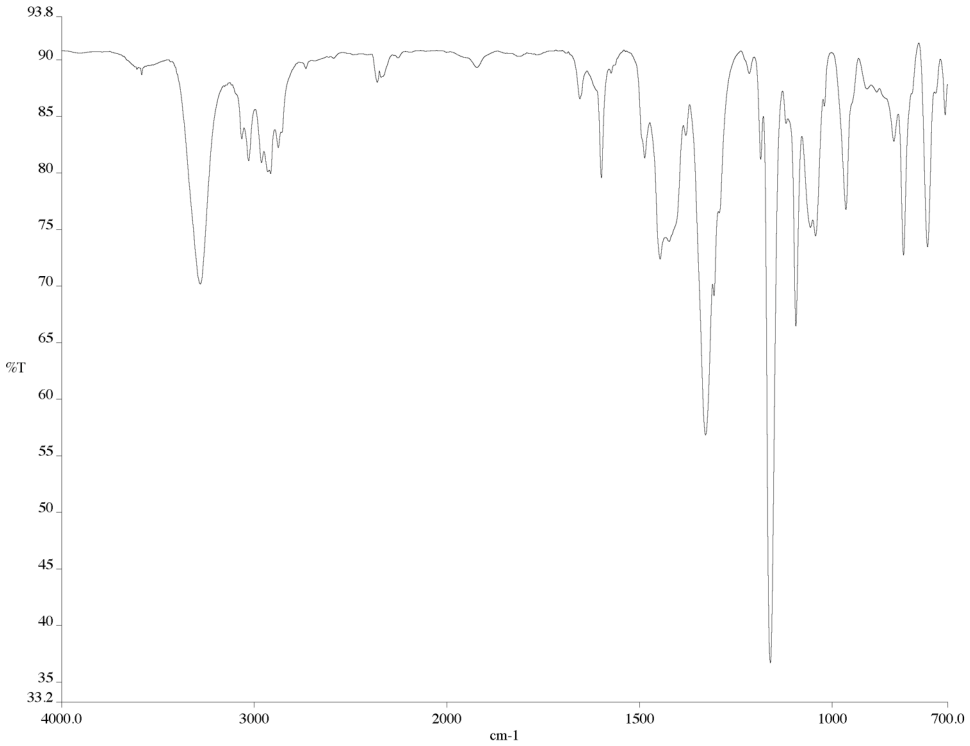


Figure A3.38 Infrared spectrum (thin film/NaCl) of compound **409**.

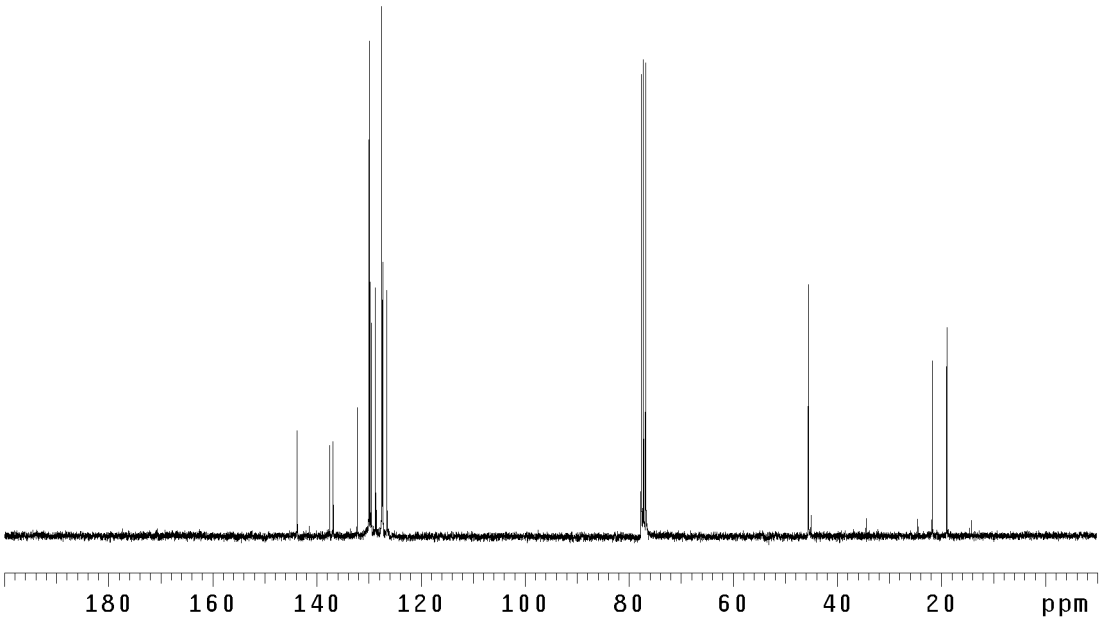


Figure A3.39 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **409**.

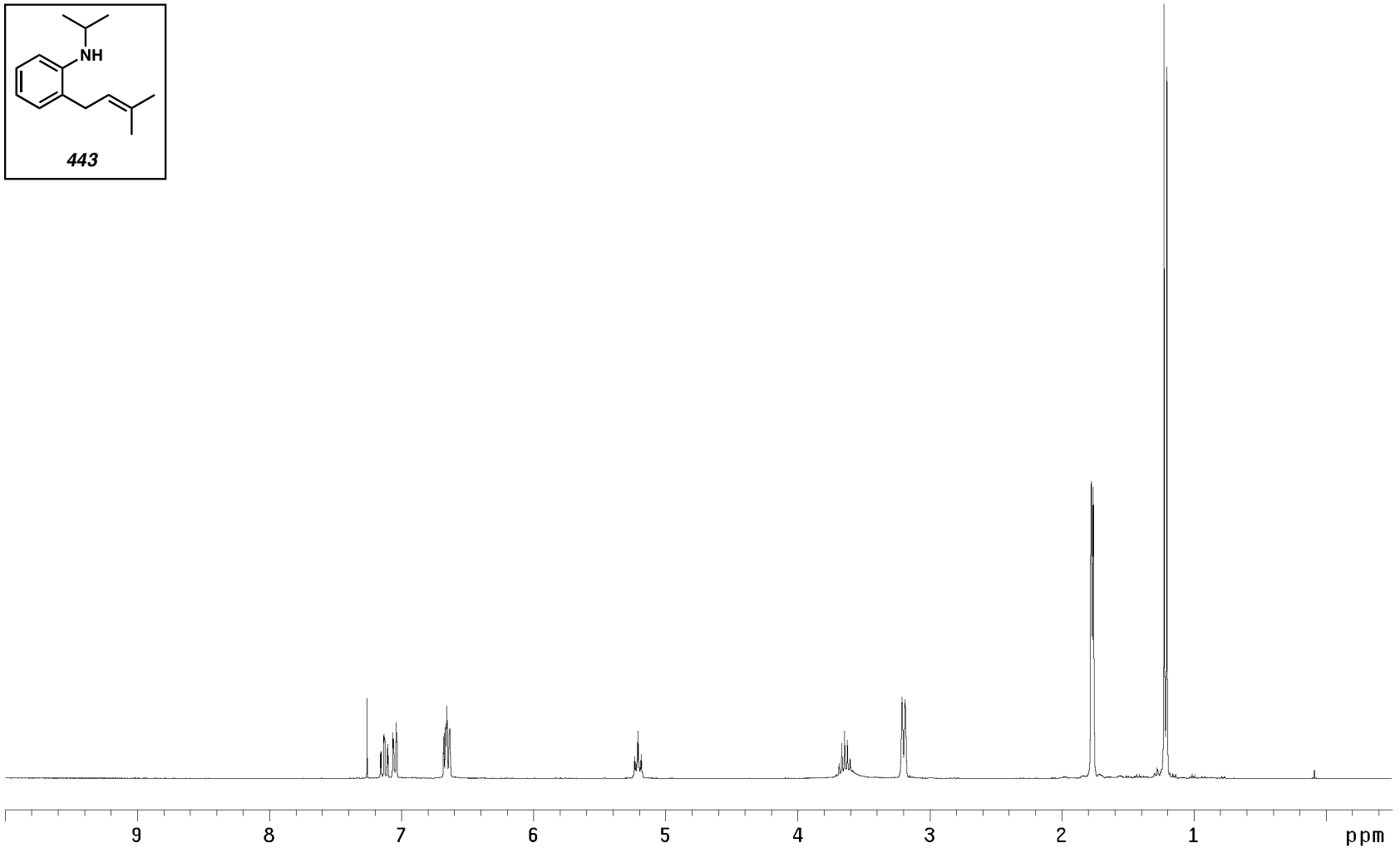


Figure A3.40 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **443**.

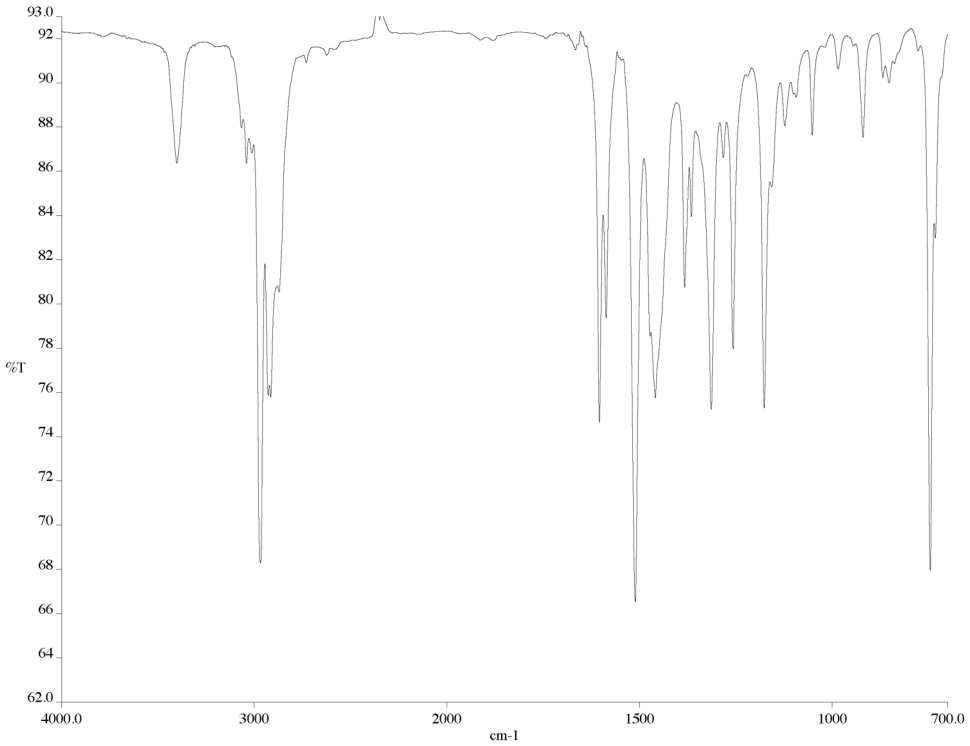


Figure A3.41 Infrared spectrum (thin film/NaCl) of compound **443**.

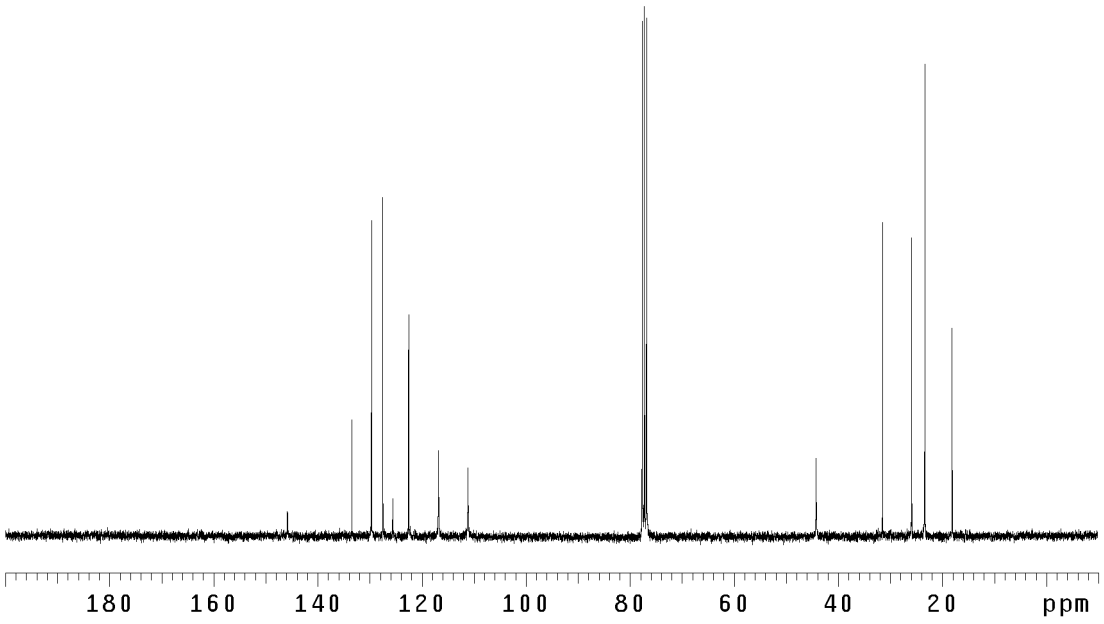


Figure A3.42 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **443**.

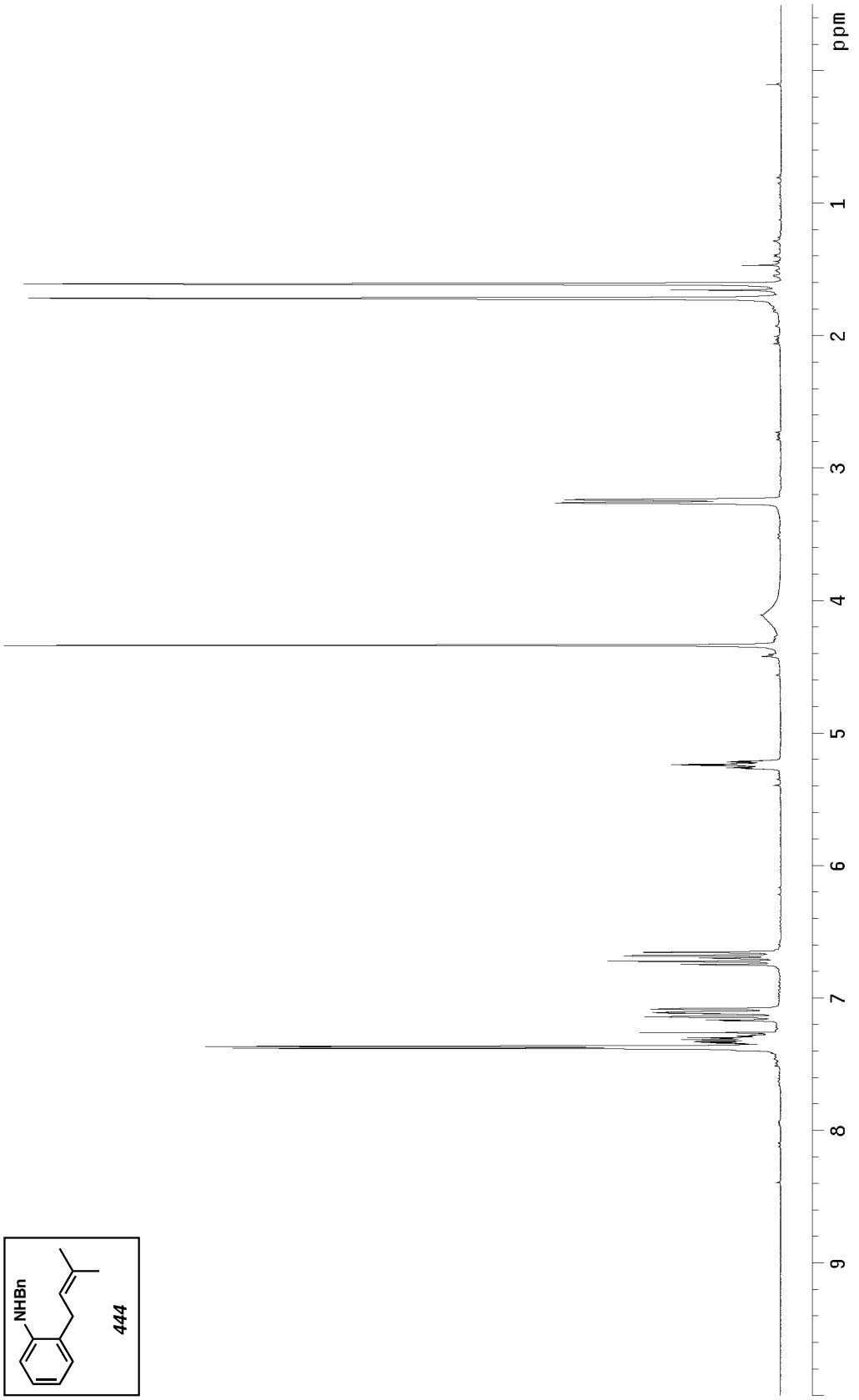


Figure A3.43 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **444**.

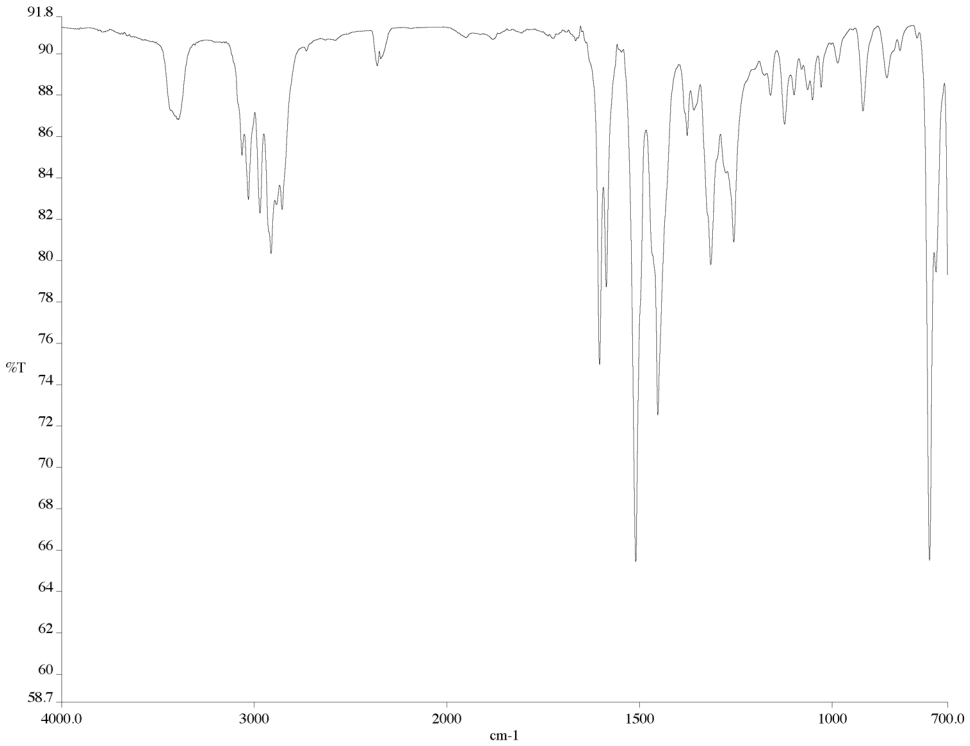


Figure A3.44 Infrared spectrum (thin film/NaCl) of compound **444**.

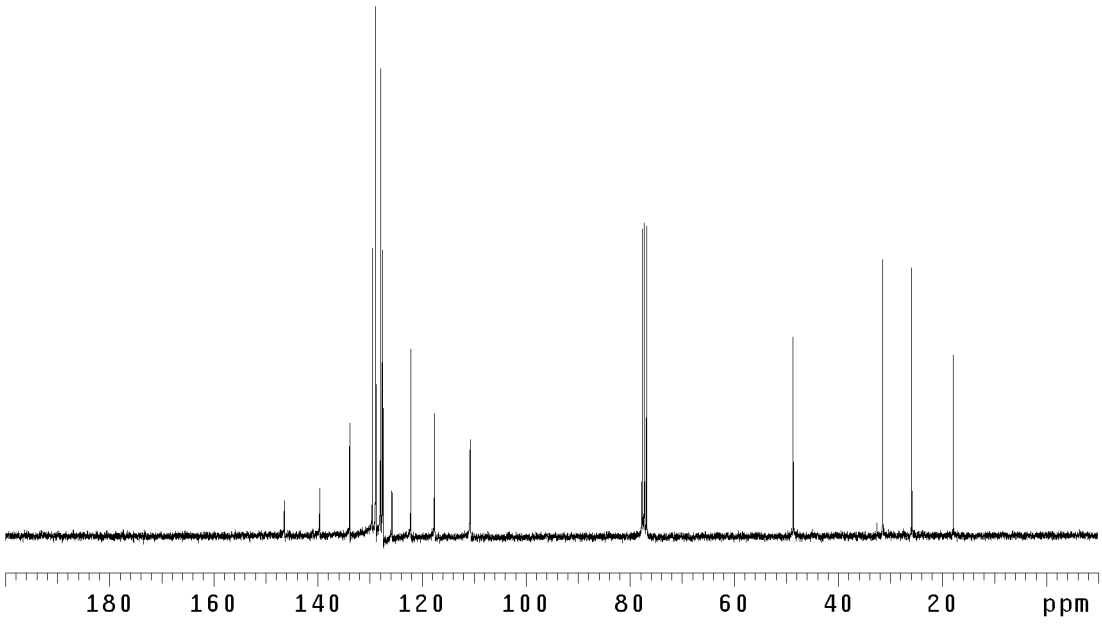


Figure A3.45 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **444**.

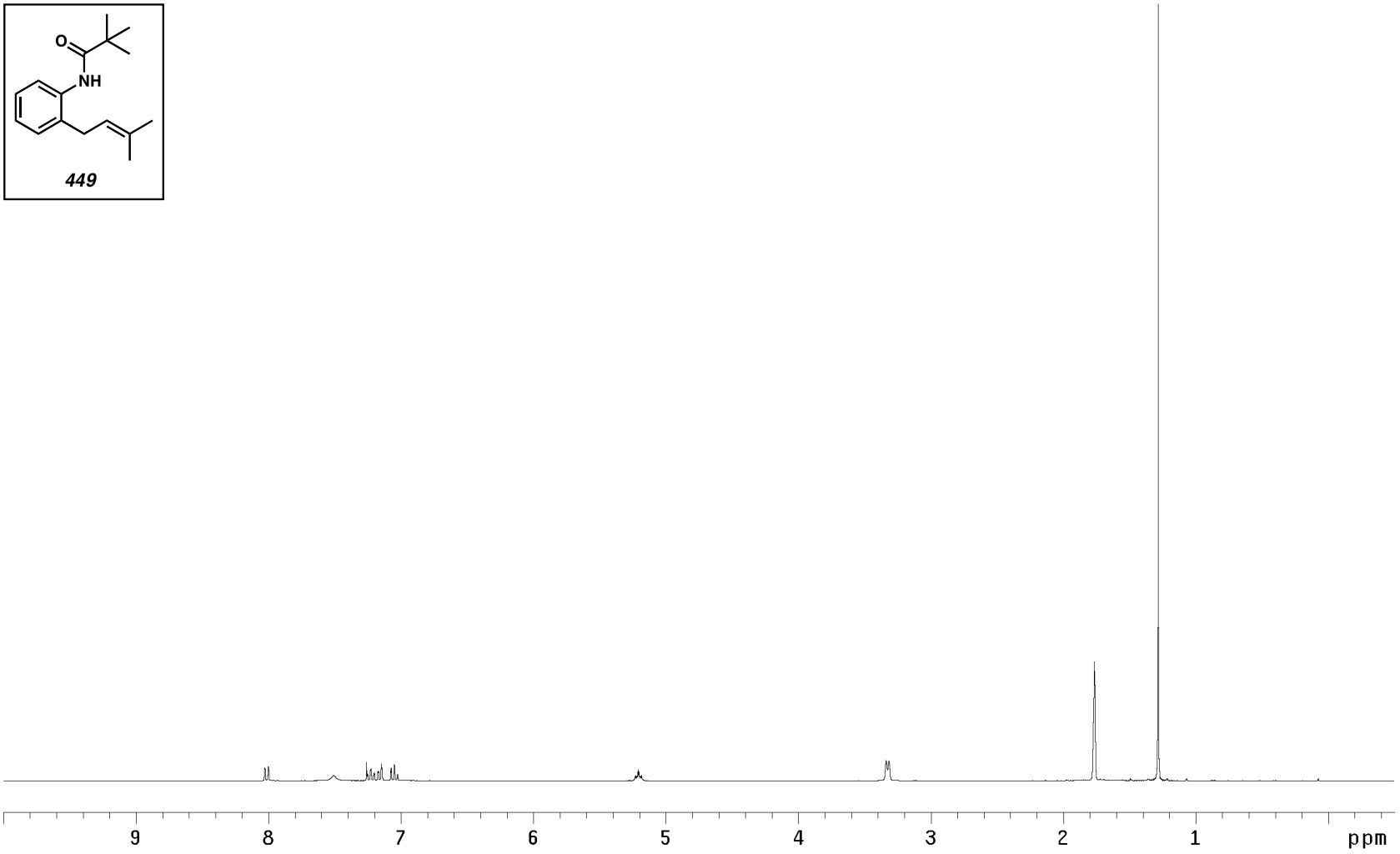


Figure A3.46 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **449**.

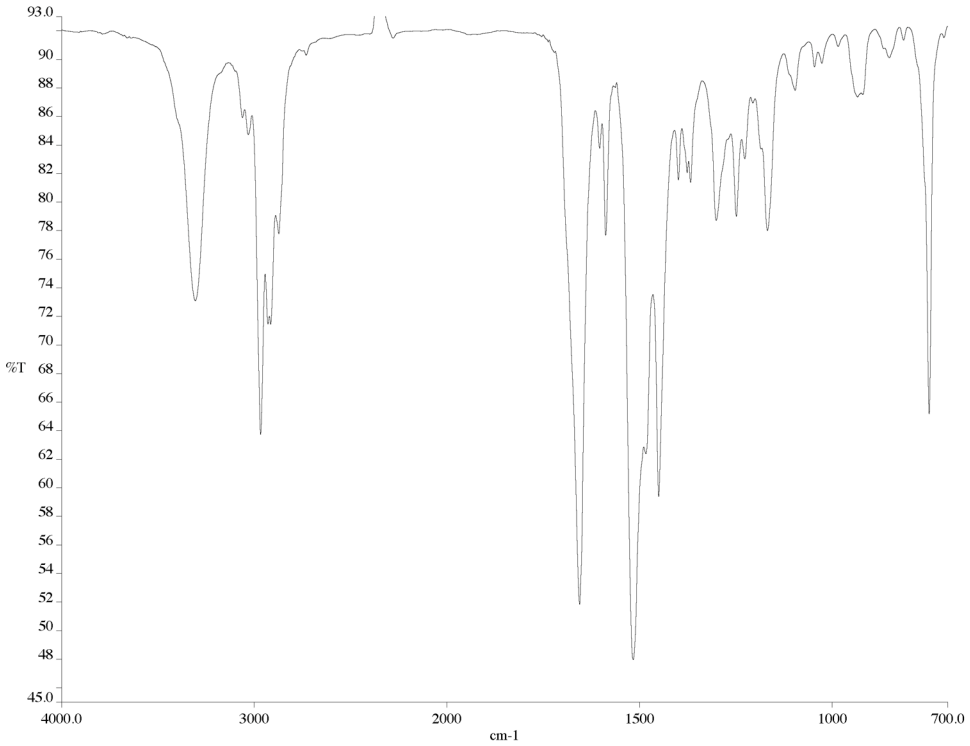


Figure A3.47 Infrared spectrum (thin film/NaCl) of compound **449**.

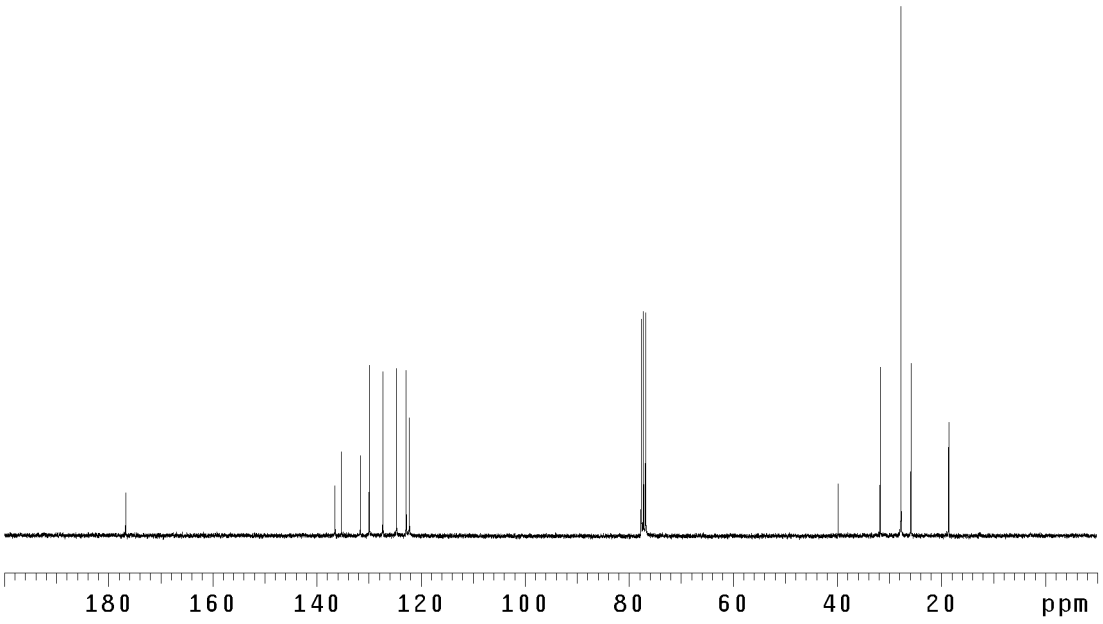


Figure A3.48 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **449**.

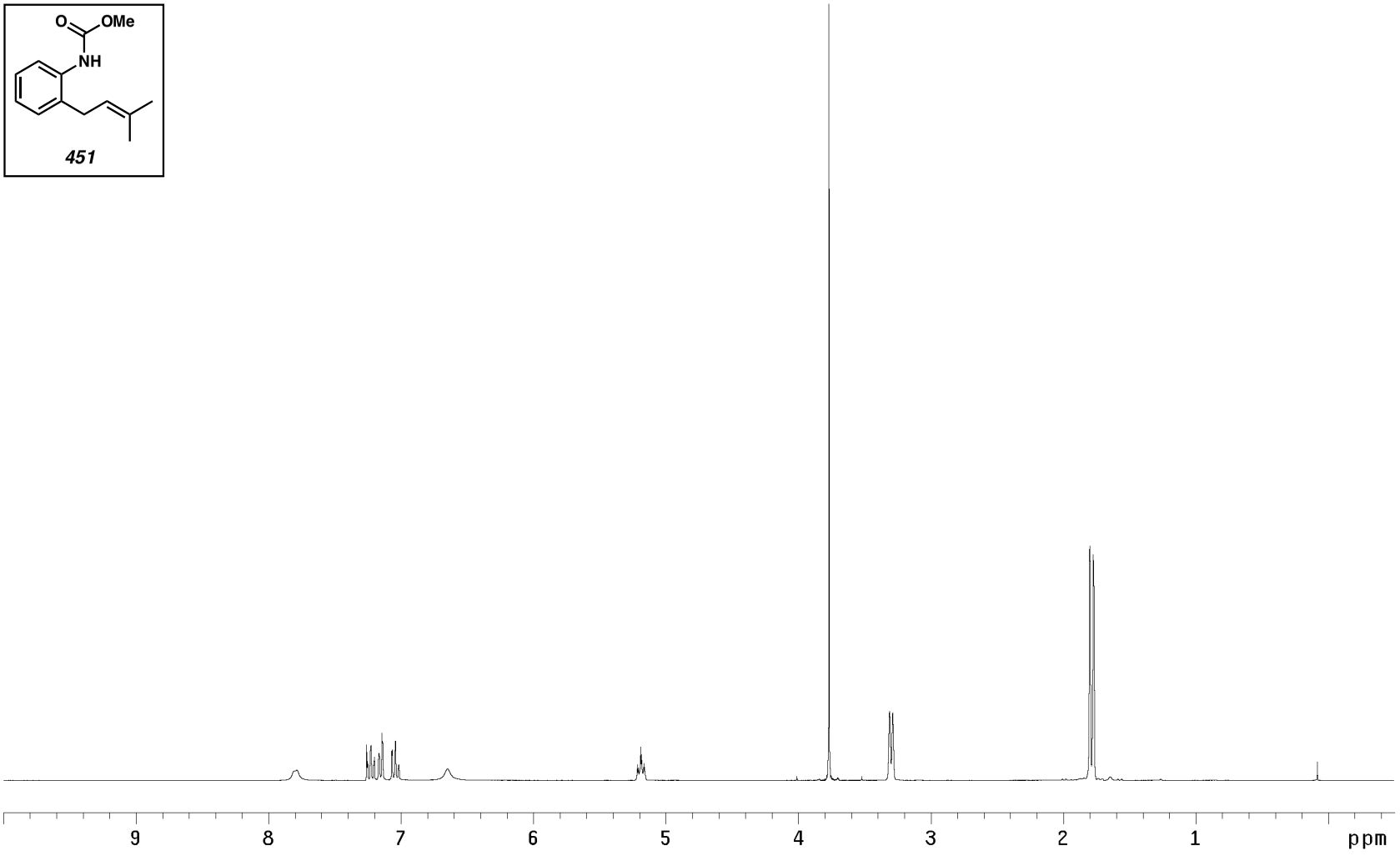


Figure A3.49 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **451**.

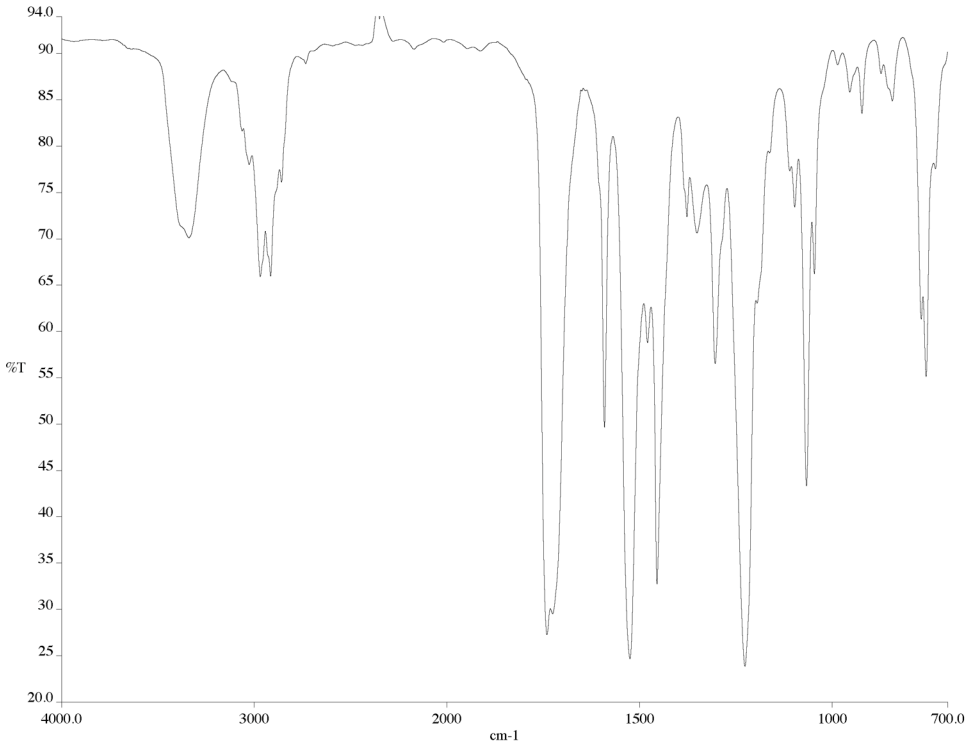


Figure A3.50 Infrared spectrum (thin film/NaCl) of compound **451**.

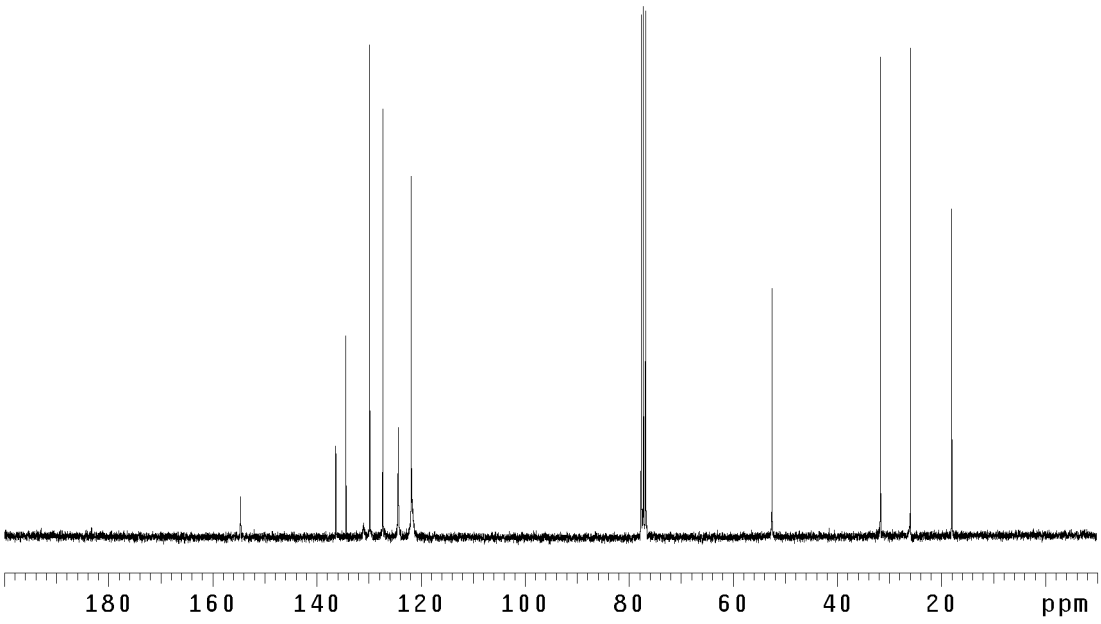


Figure A3.51 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **451**.

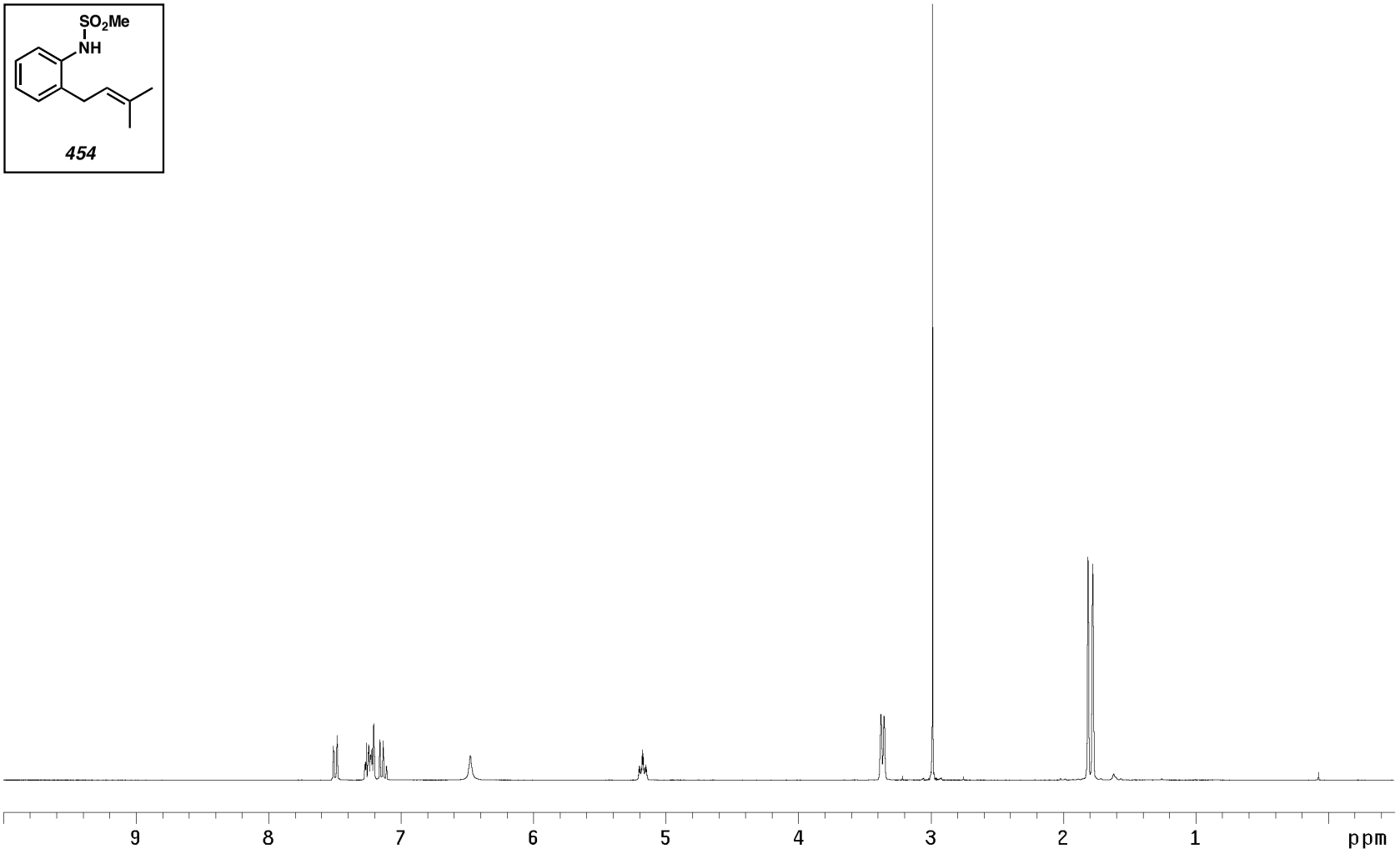


Figure A3.52 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **454**.

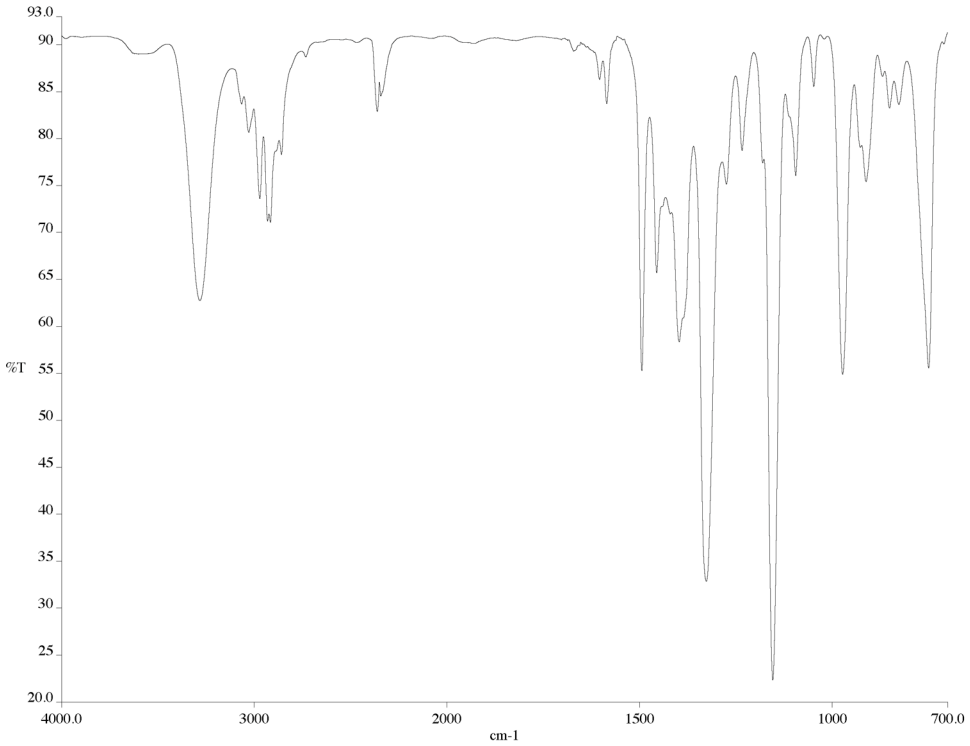


Figure A3.53 Infrared spectrum (thin film/NaCl) of compound **454**.

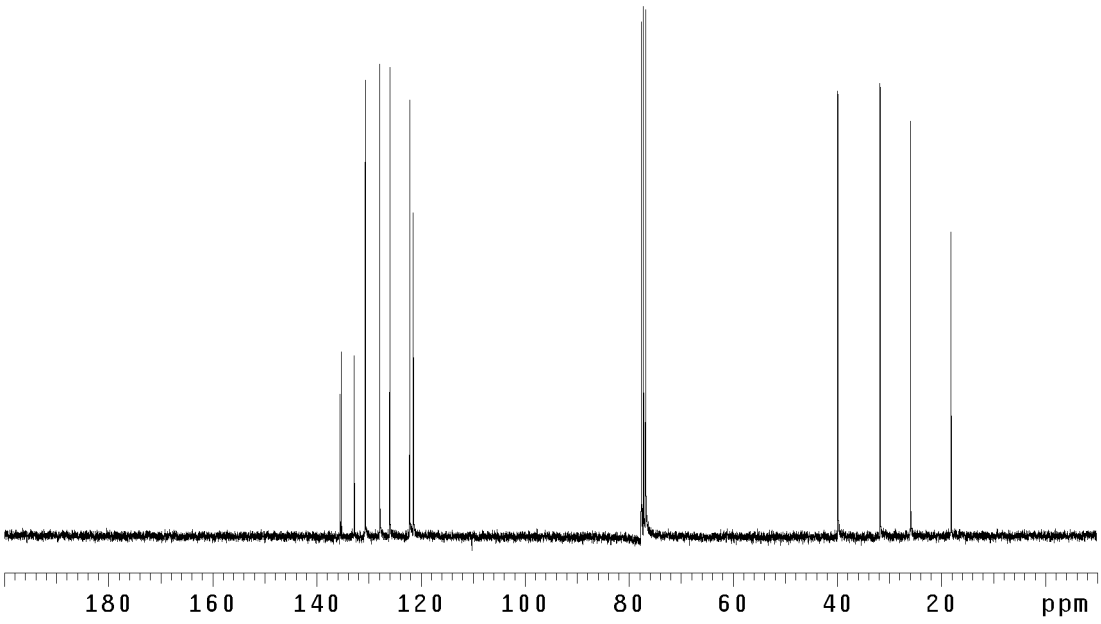


Figure A3.54 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **454**.

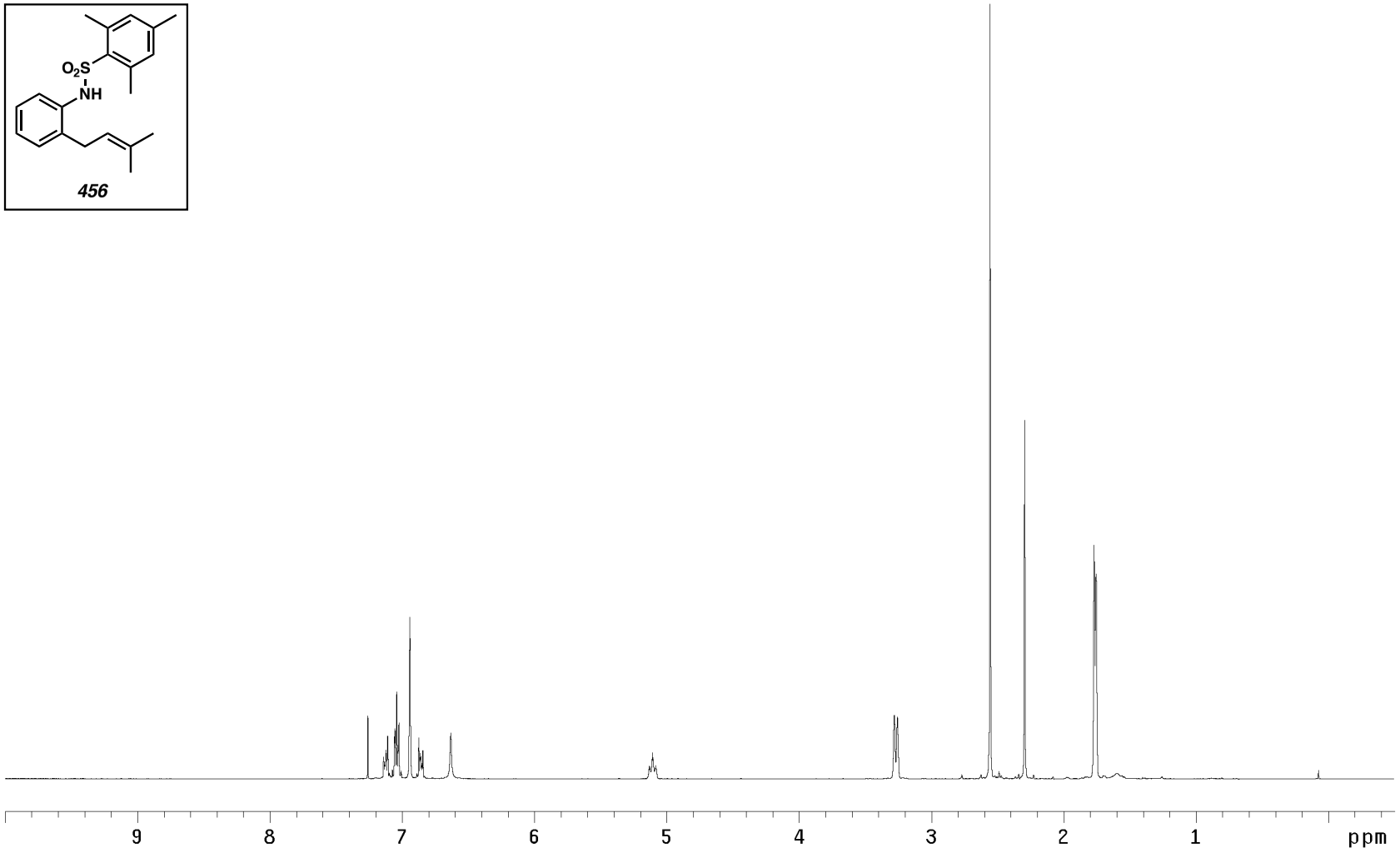


Figure A3.55 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **456**.

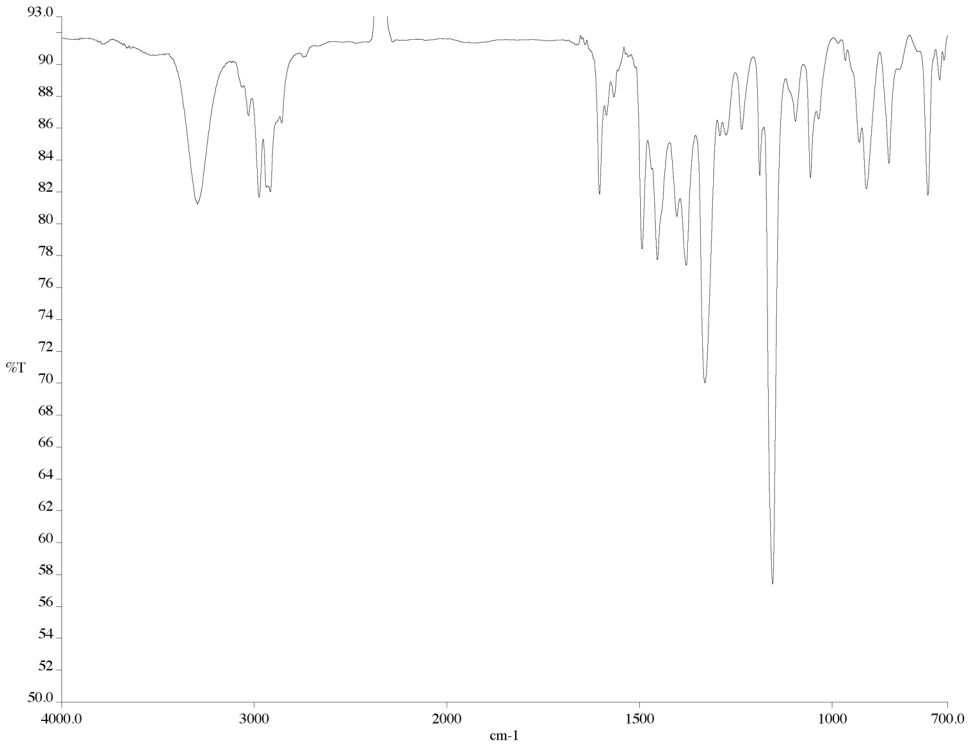


Figure A3.56 Infrared spectrum (thin film/NaCl) of compound **456**.

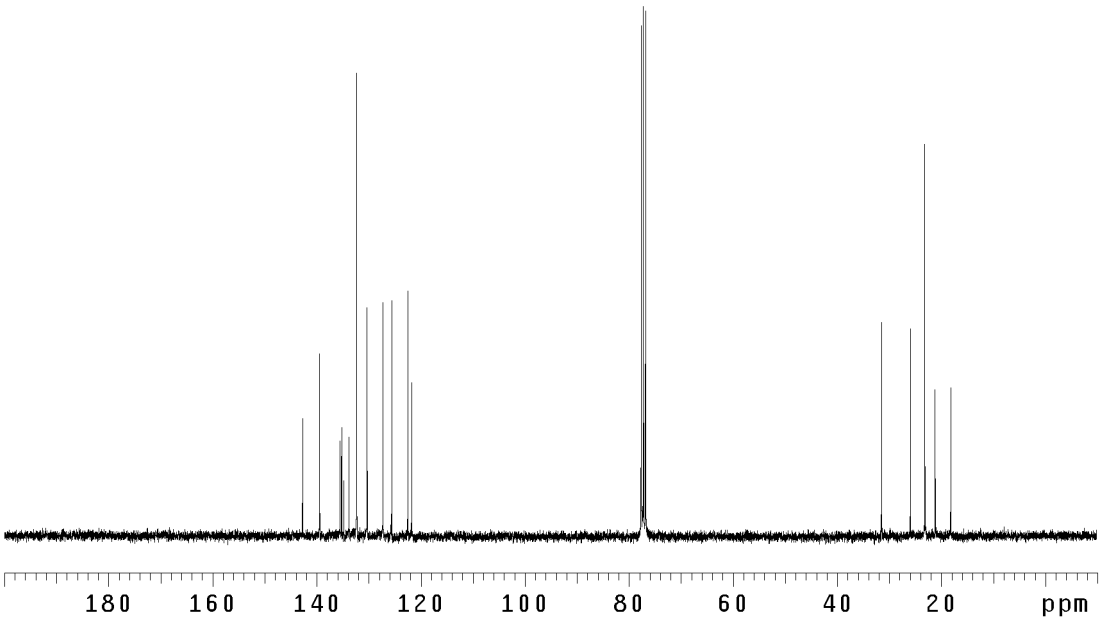


Figure A3.57 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **456**.

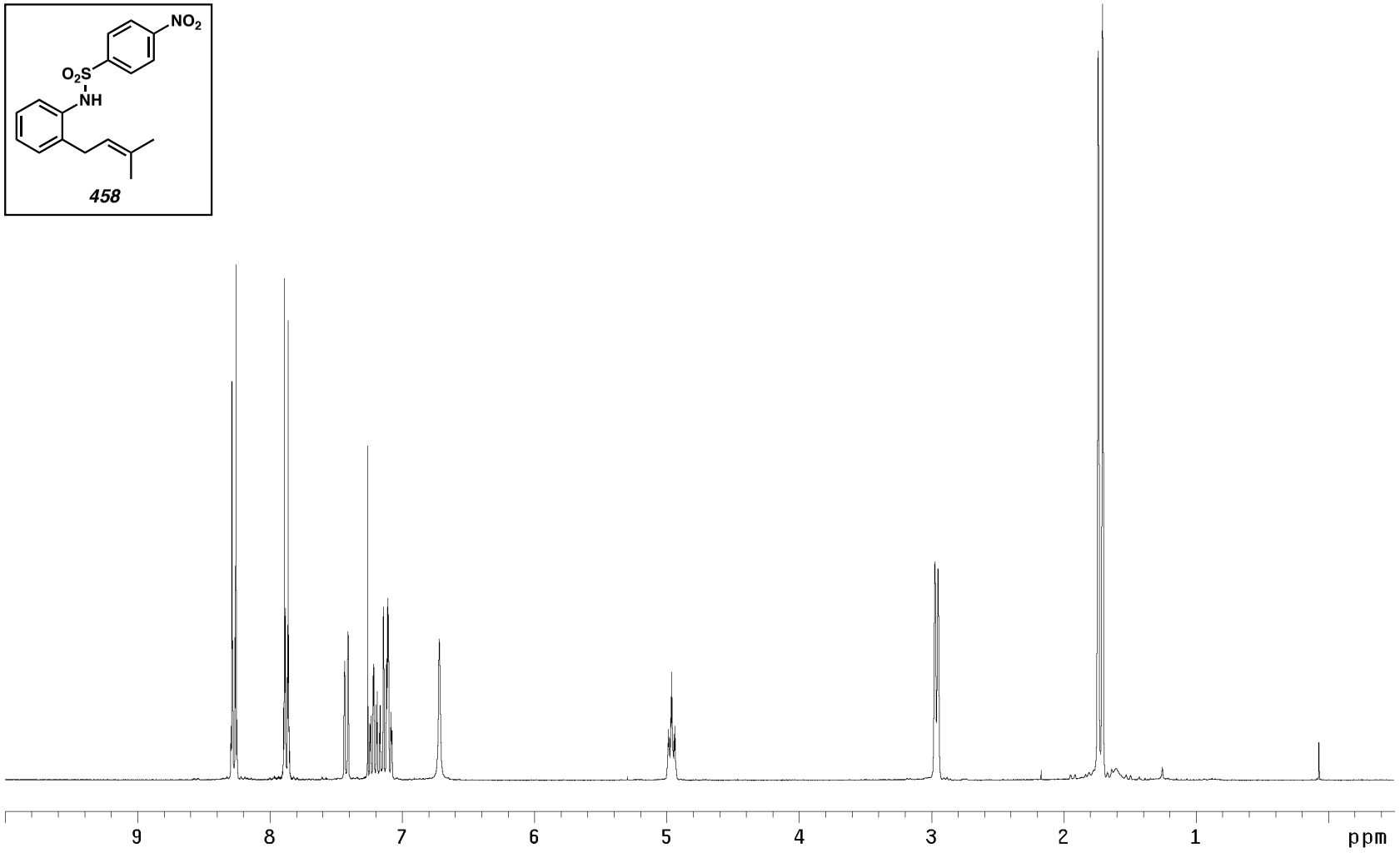


Figure A3.58 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **458**.

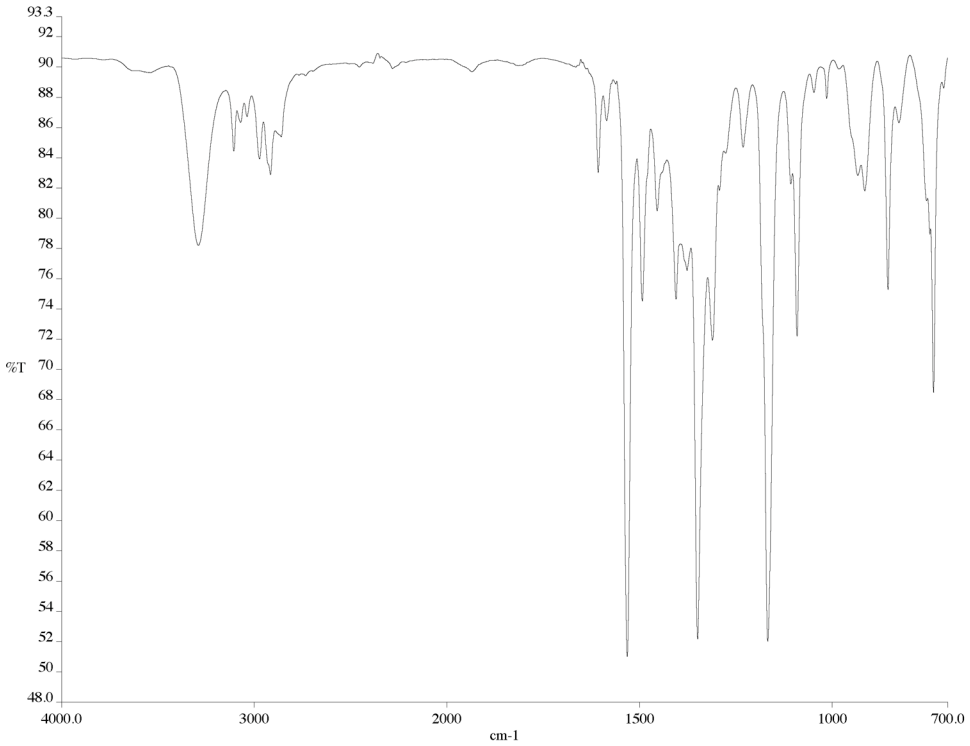


Figure A3.59 Infrared spectrum (thin film/NaCl) of compound **458**.

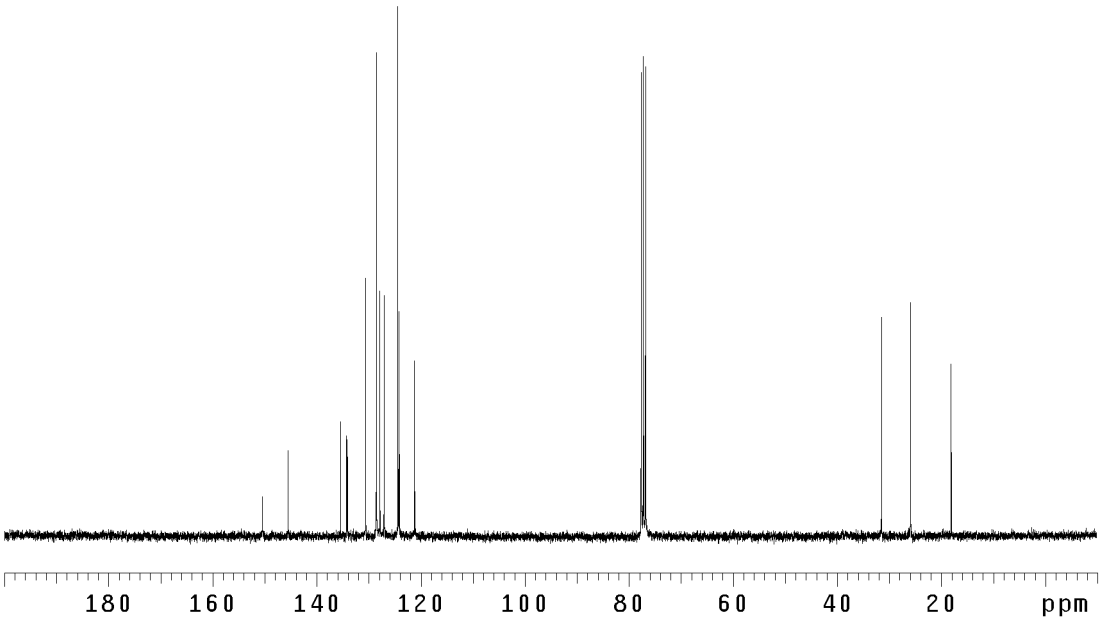


Figure A3.60 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **458**.

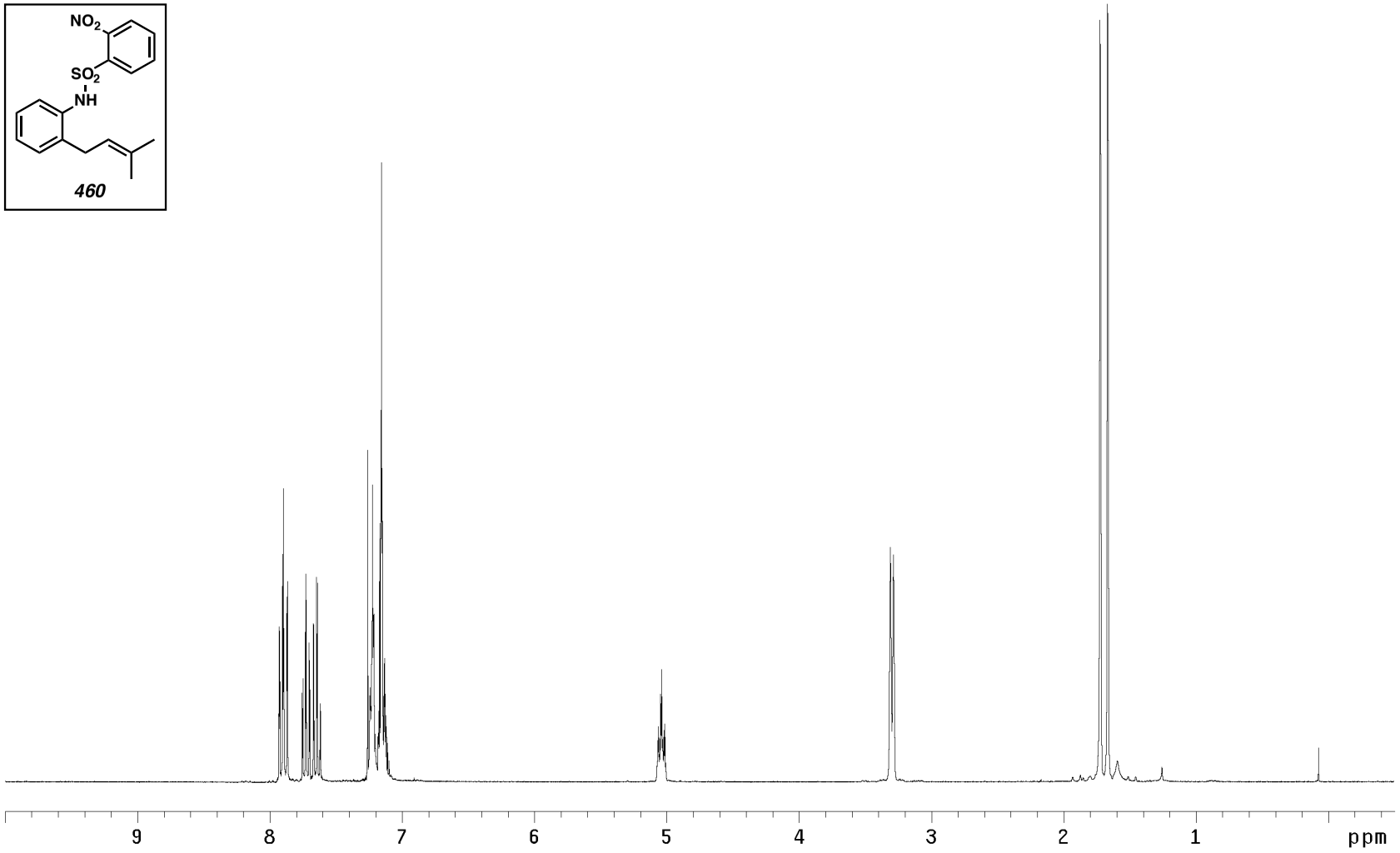


Figure A3.61 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **460**.

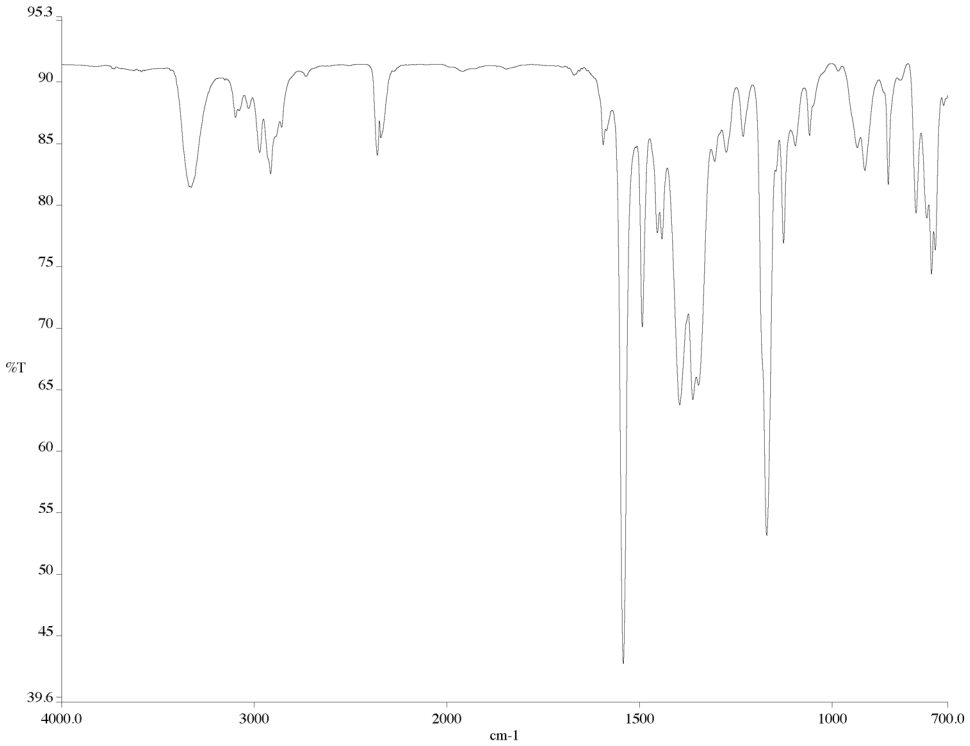


Figure A3.62 Infrared spectrum (thin film/NaCl) of compound **460**.

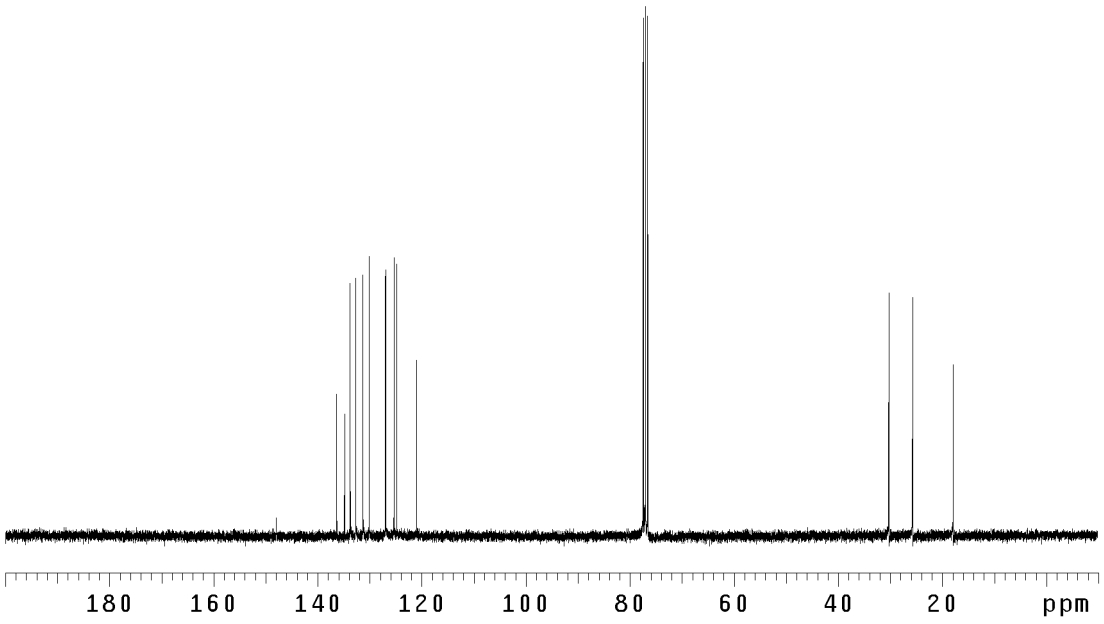


Figure A3.63 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **460**.

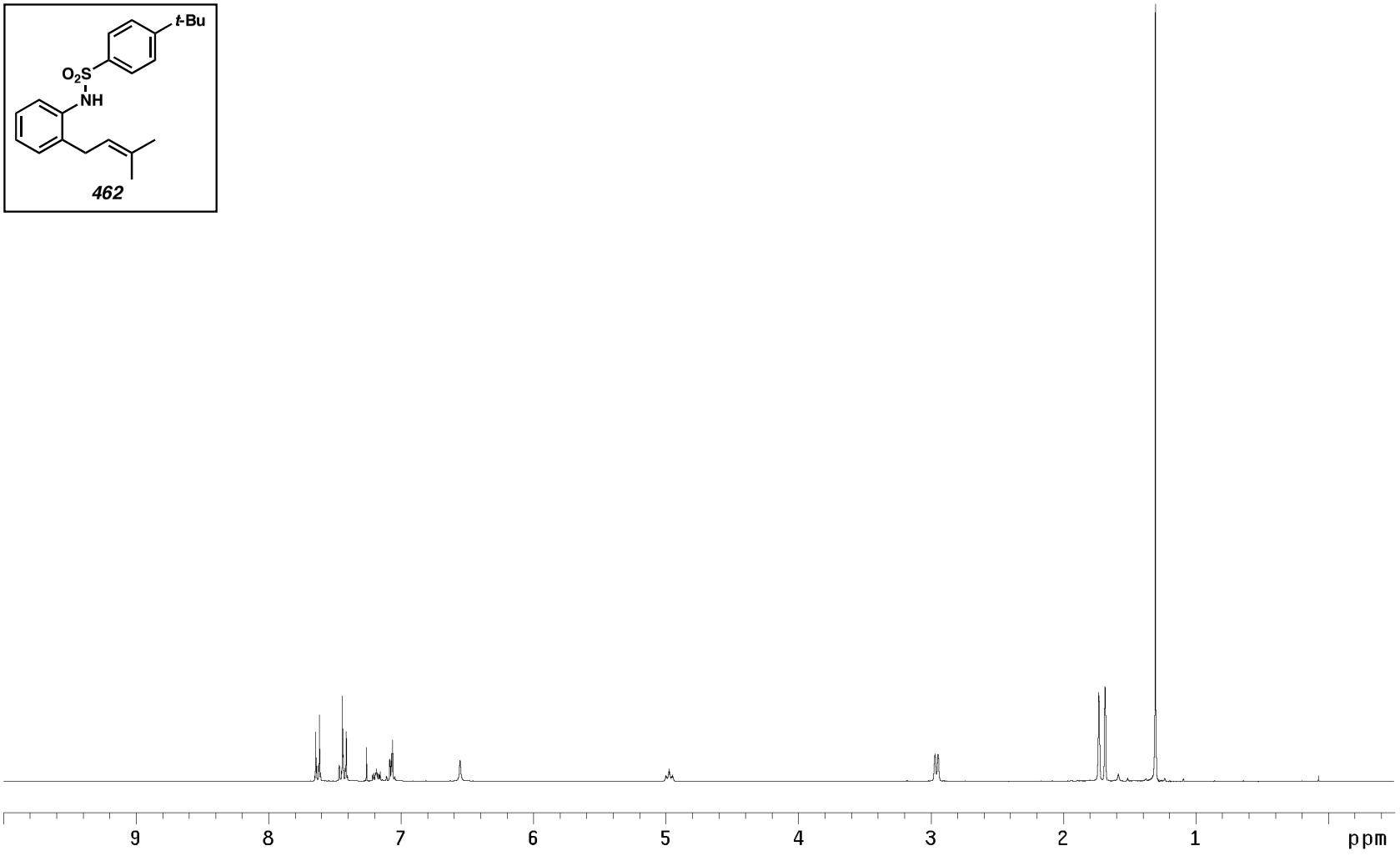


Figure A3.64 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **462**.

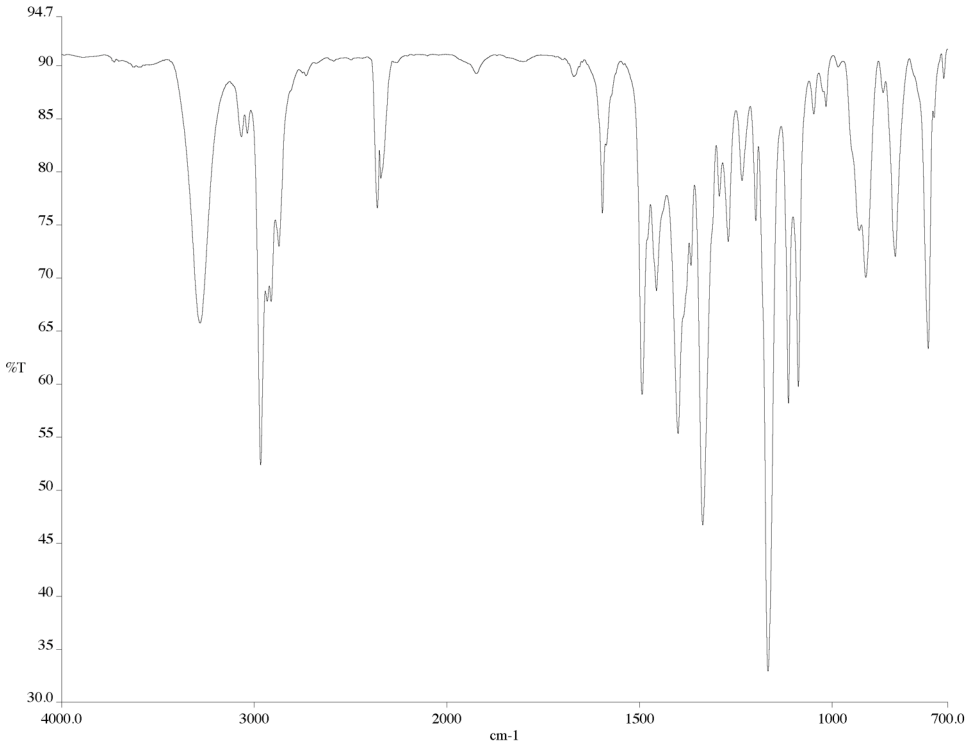


Figure A3.65 Infrared spectrum (thin film/NaCl) of compound **462**.

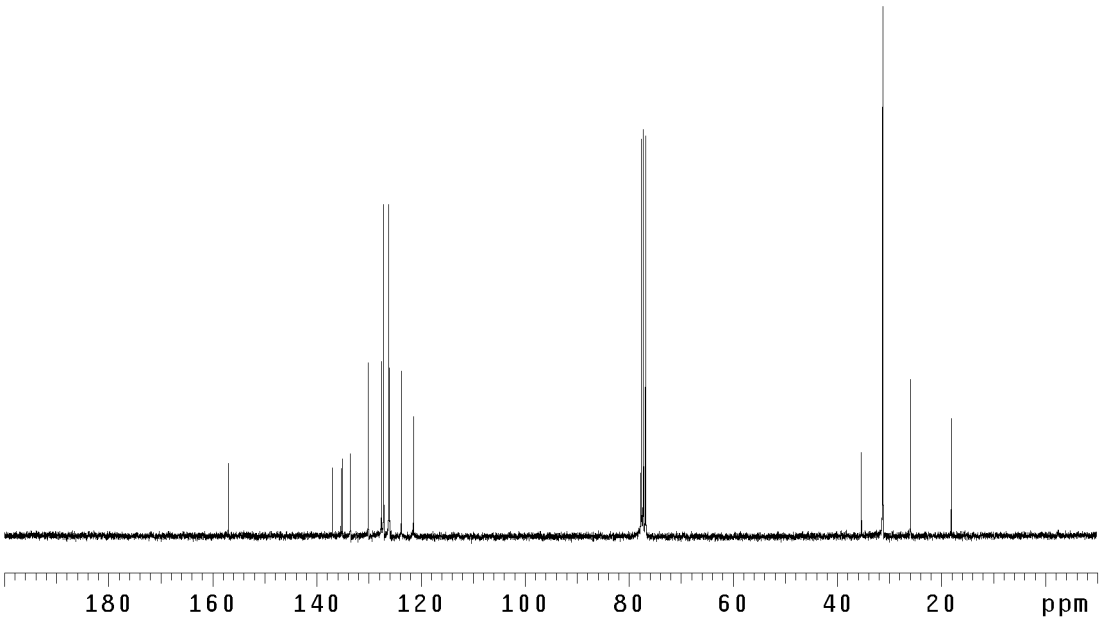


Figure A3.66 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **462**.

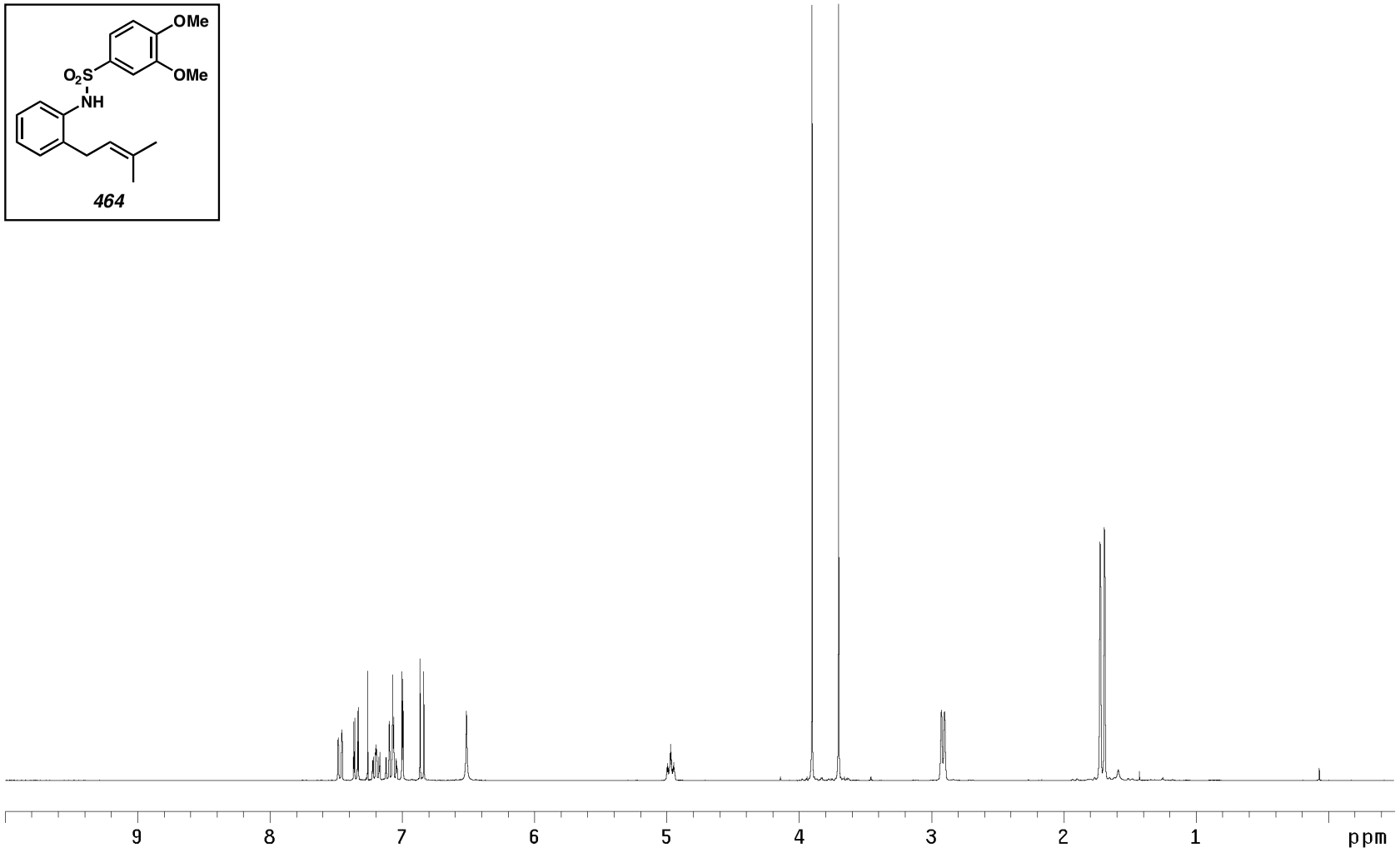


Figure A3.67 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **464**.

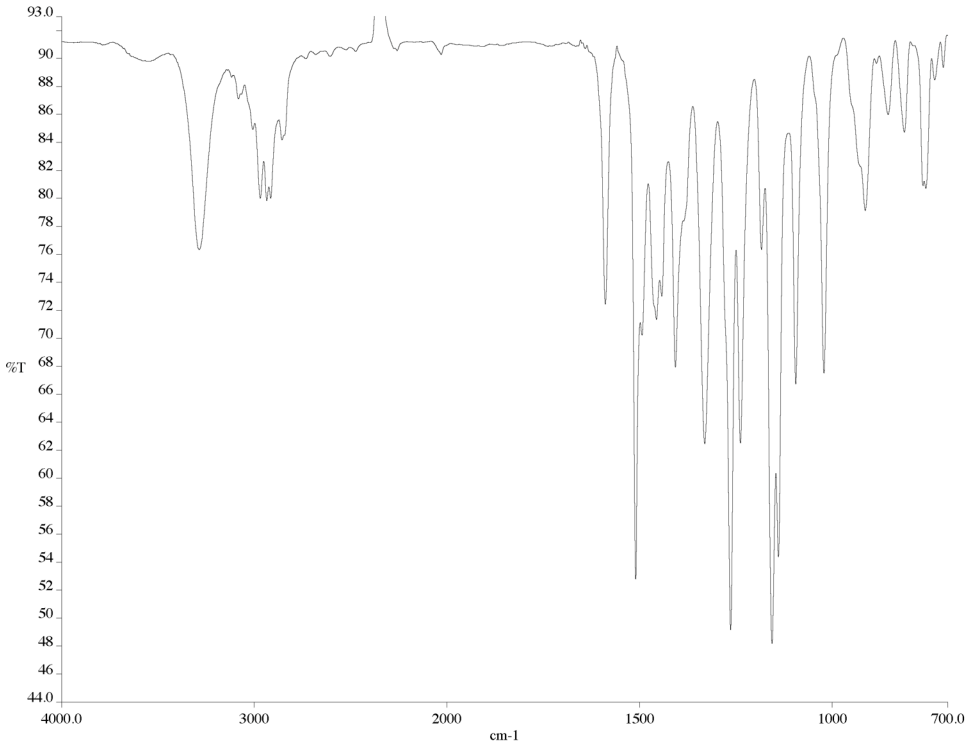


Figure A3.68 Infrared spectrum (thin film/NaCl) of compound **464**.

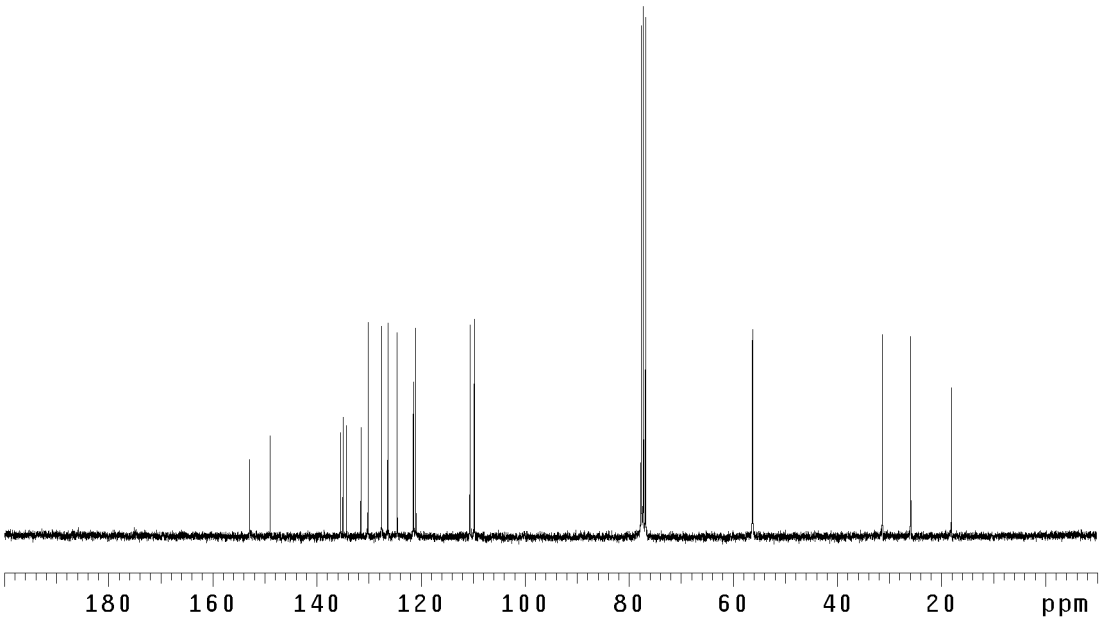


Figure A3.69 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **464**.

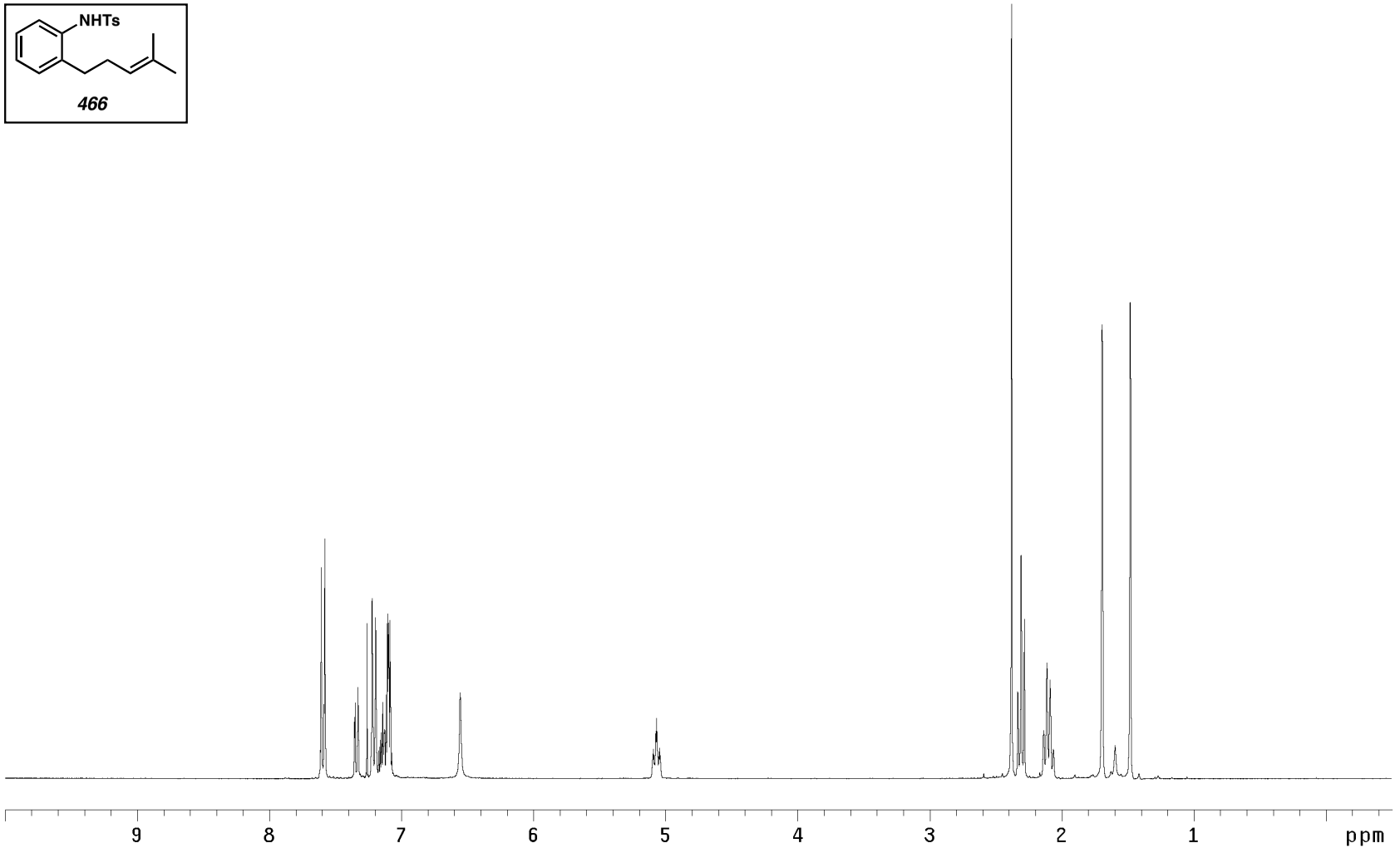


Figure A3.70 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **466**.

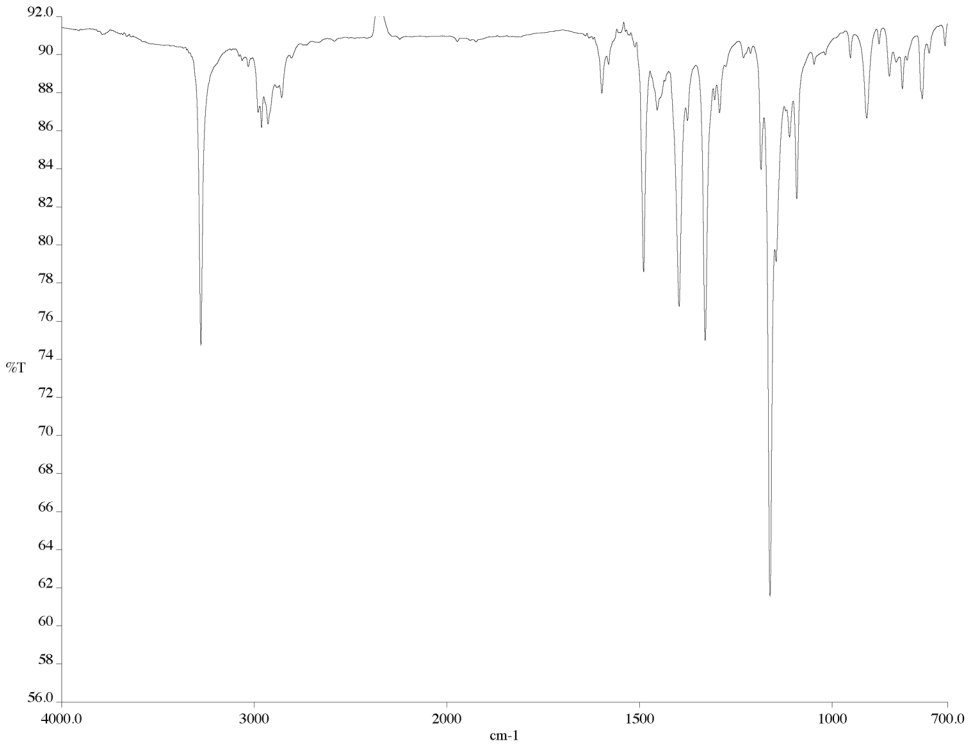


Figure A3.71 Infrared spectrum (thin film/NaCl) of compound **466**.

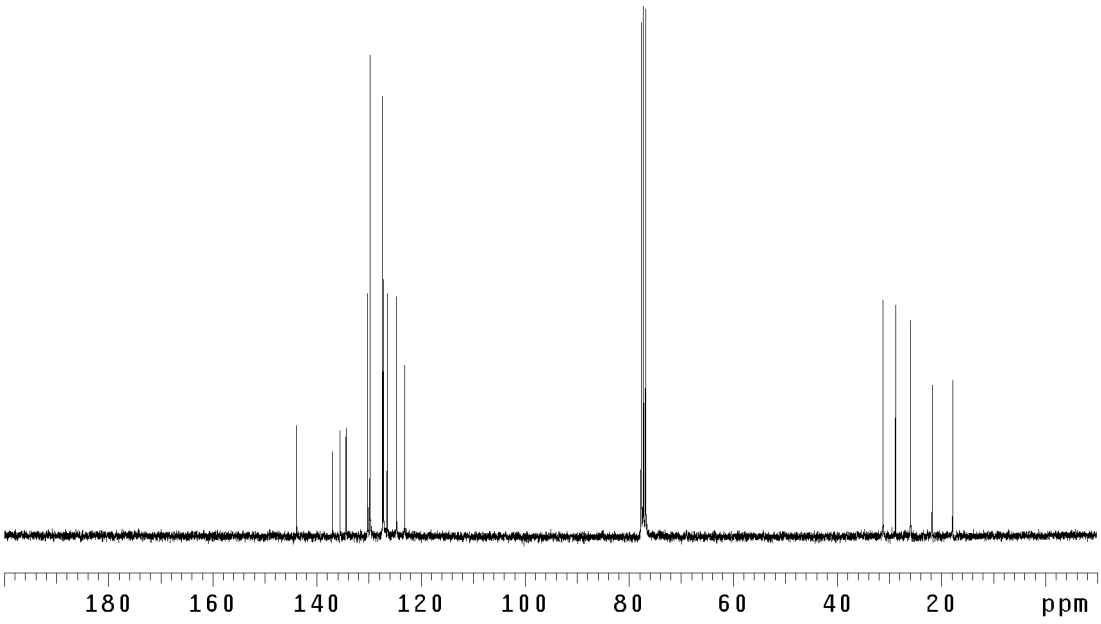


Figure A3.72 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **466**.

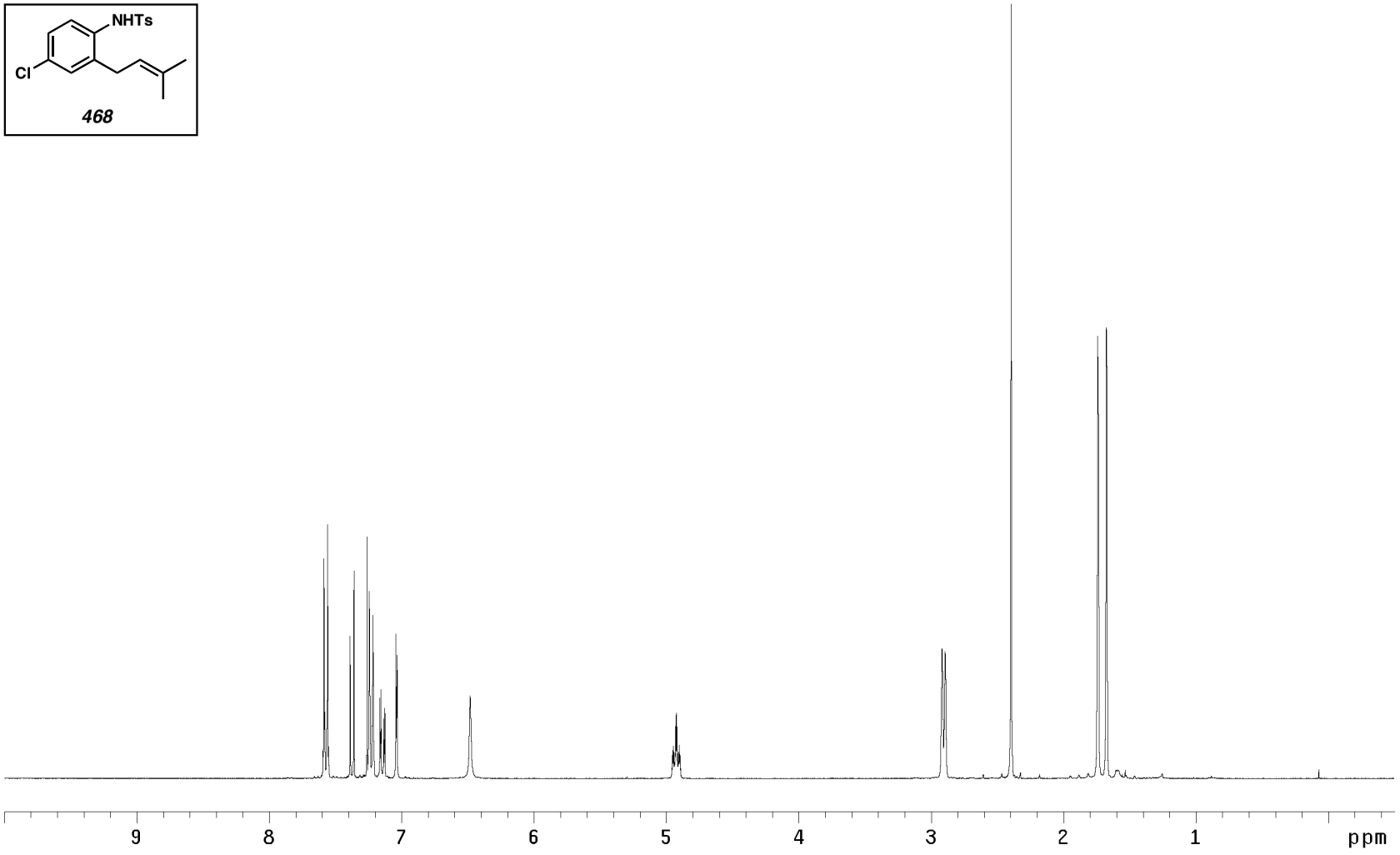


Figure A3.73 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **468**.

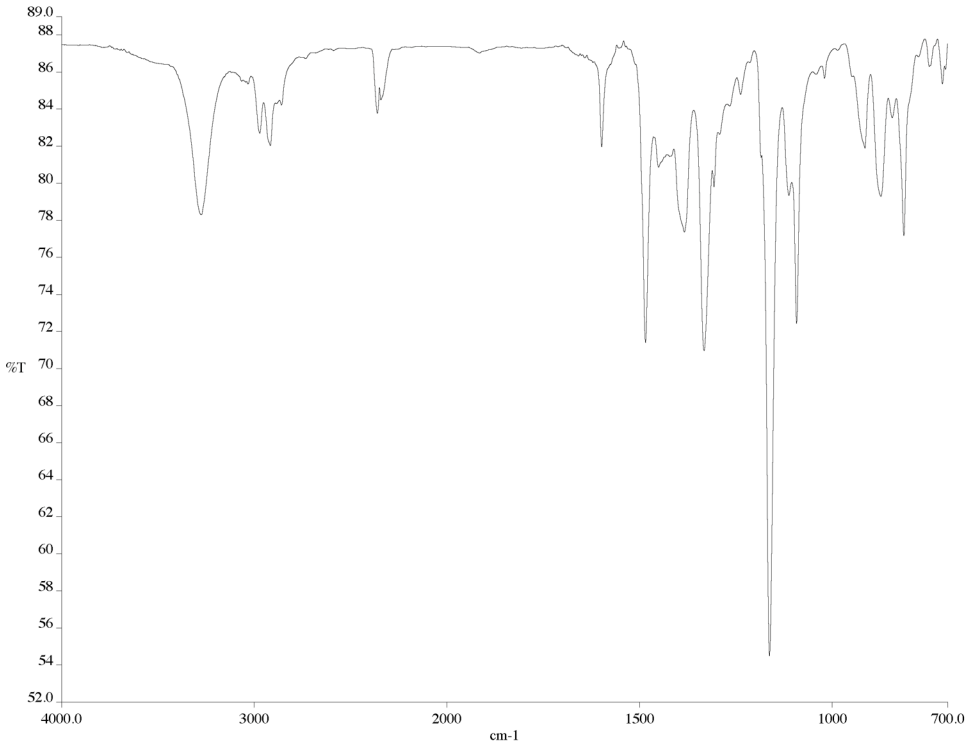


Figure A3.74 Infrared spectrum (thin film/NaCl) of compound **468**.

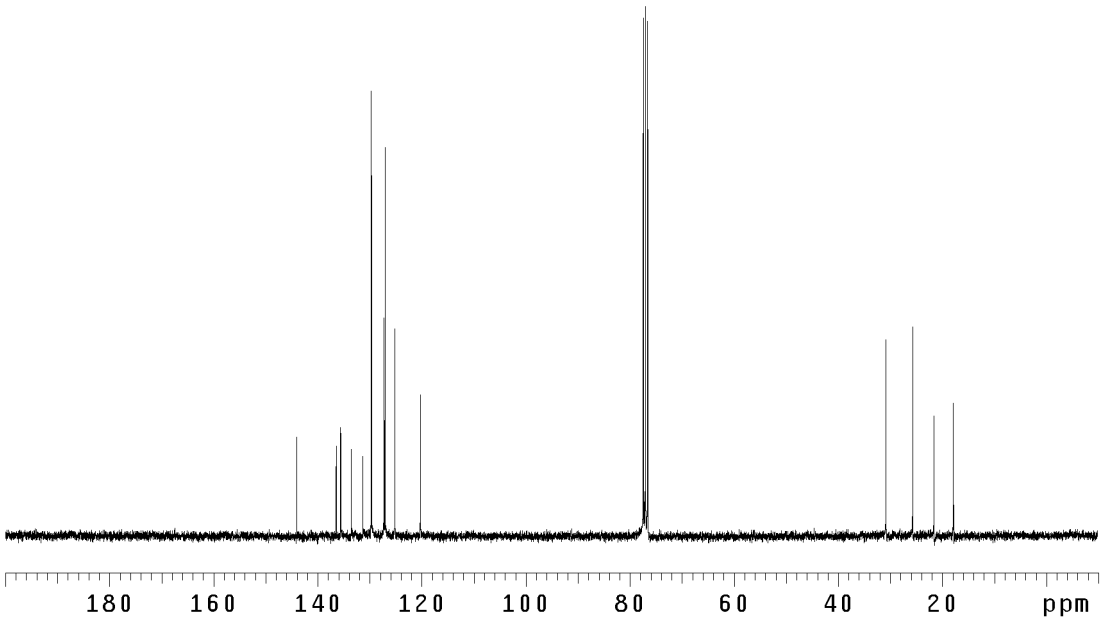


Figure A3.75 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **468**.

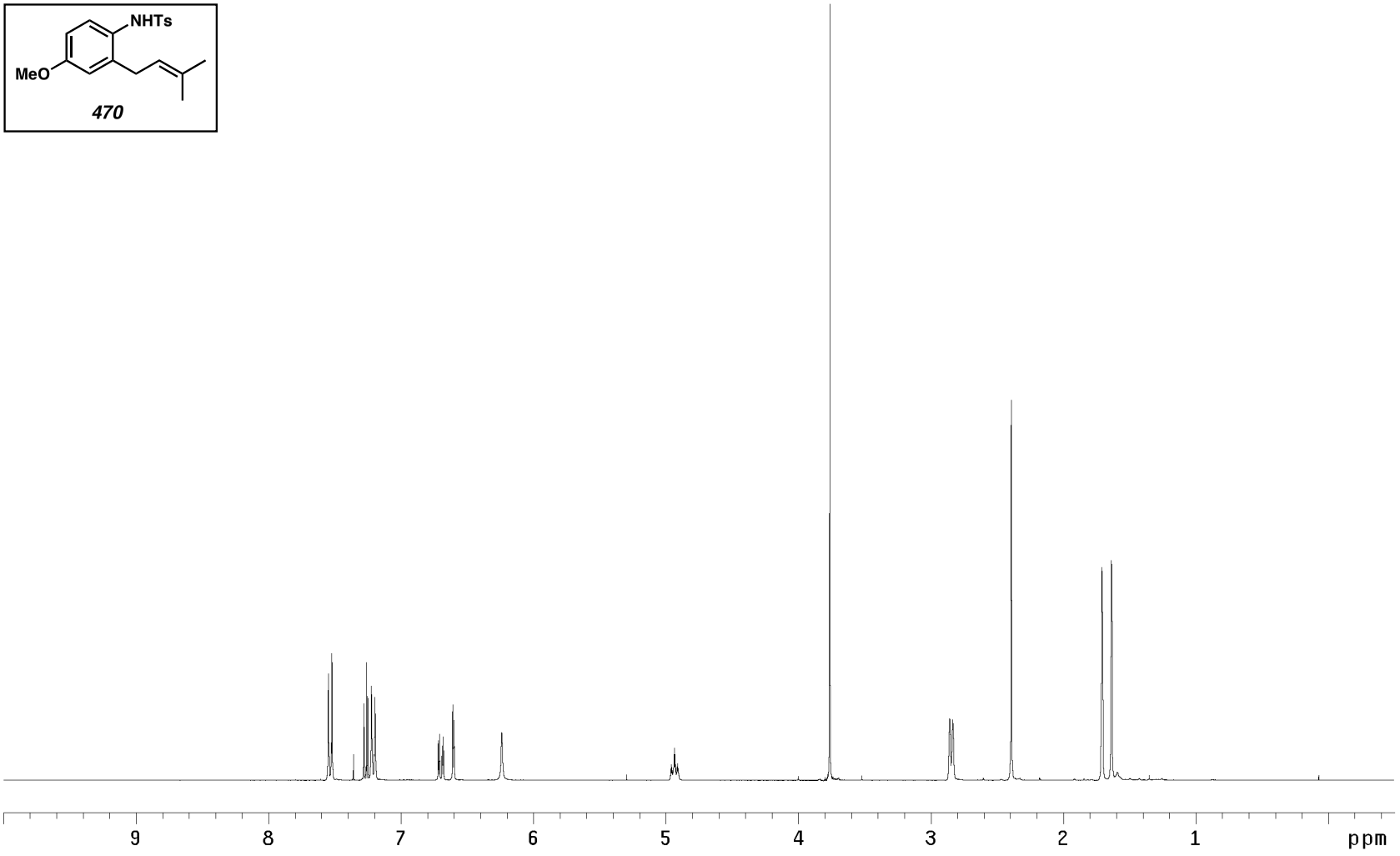


Figure A3.76 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **470**.

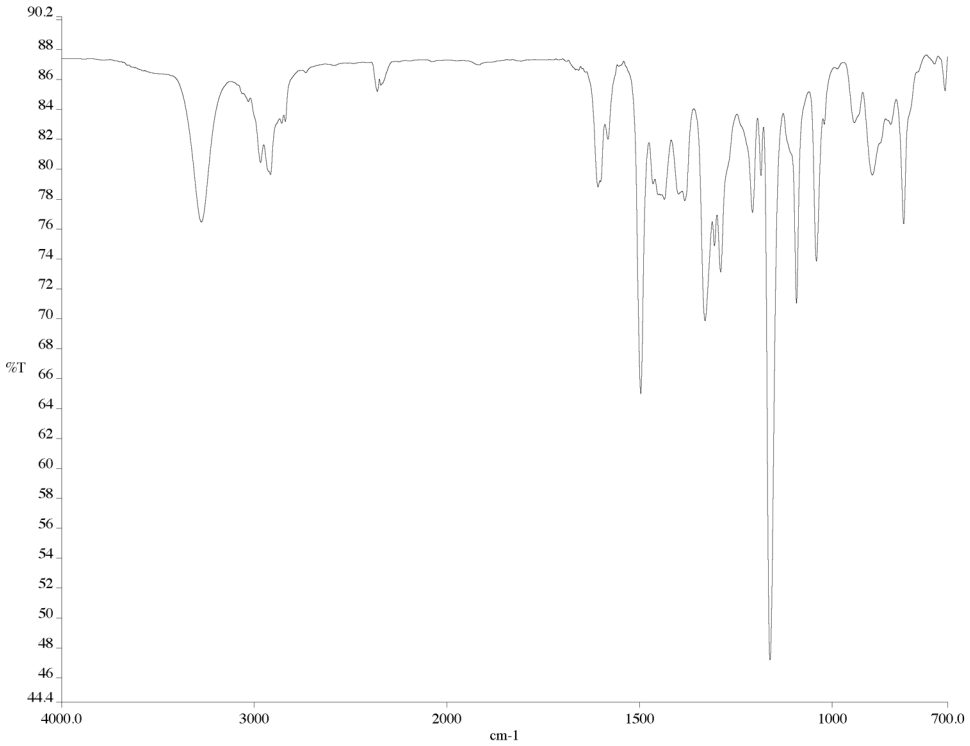


Figure A3.77 Infrared spectrum (thin film/NaCl) of compound **470**.

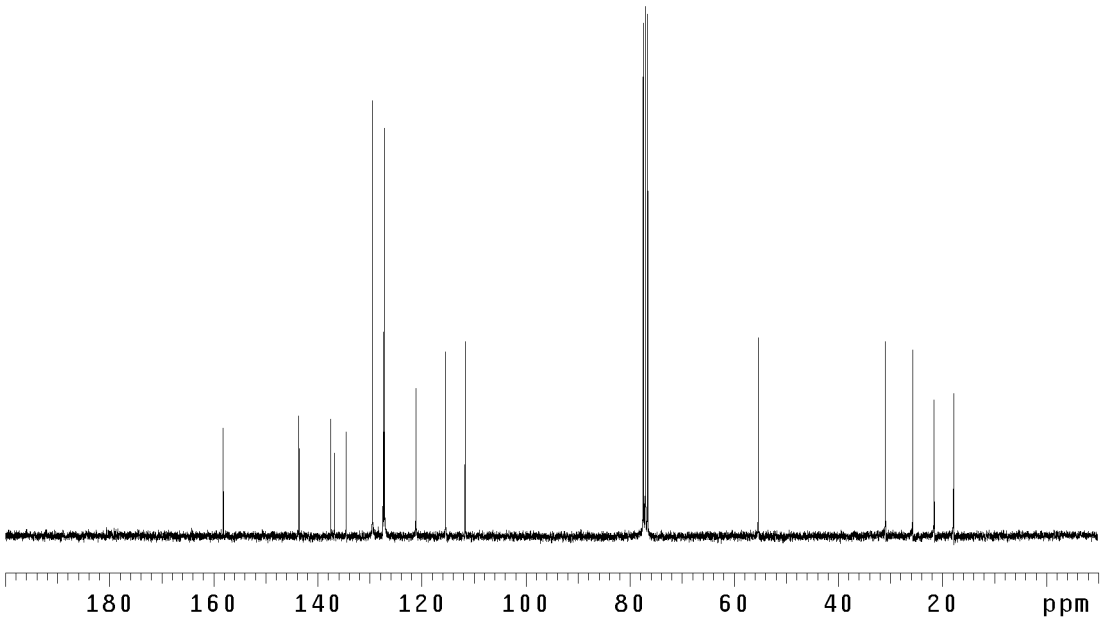


Figure A3.78 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **470**.

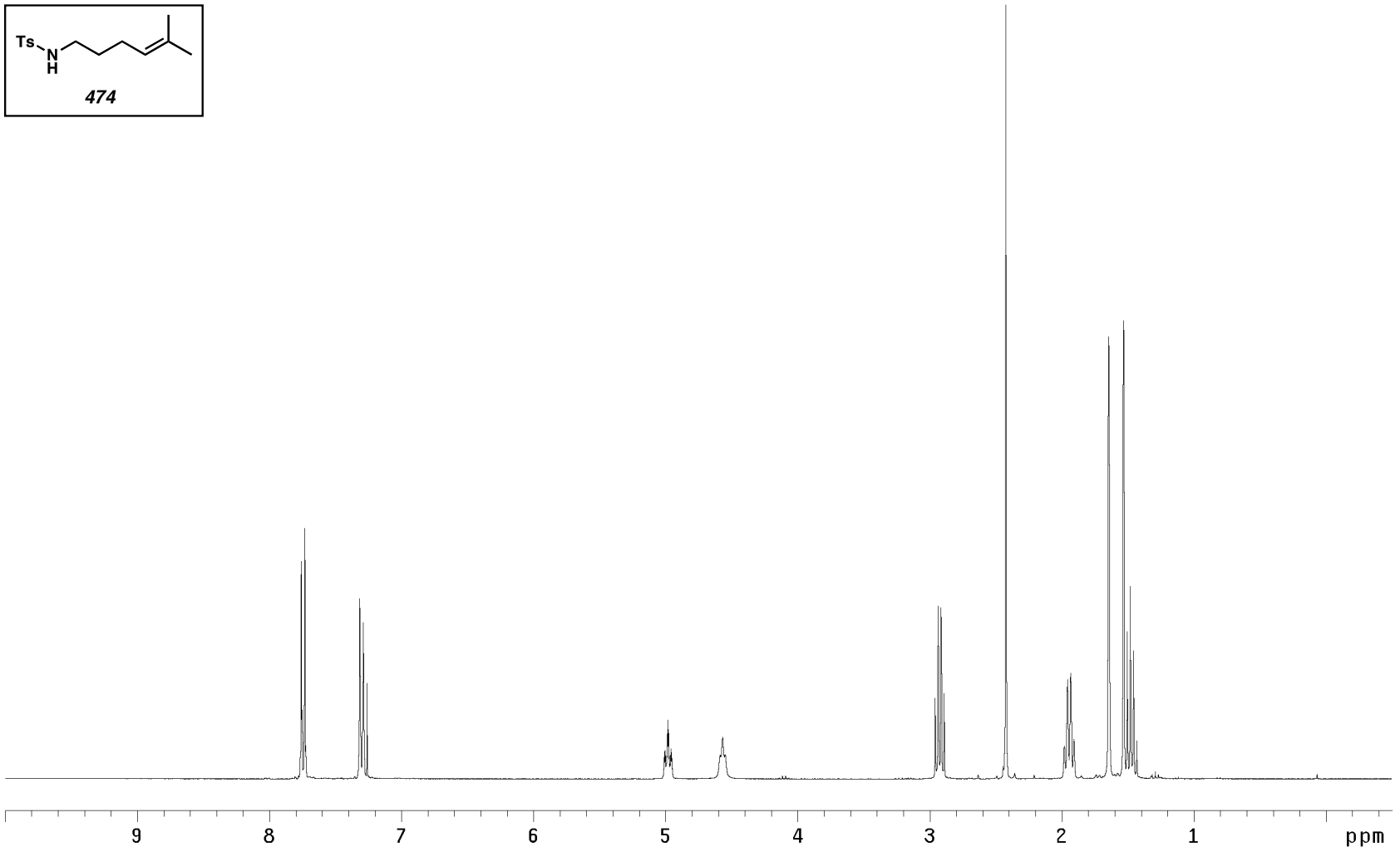


Figure A3.79 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **474**.

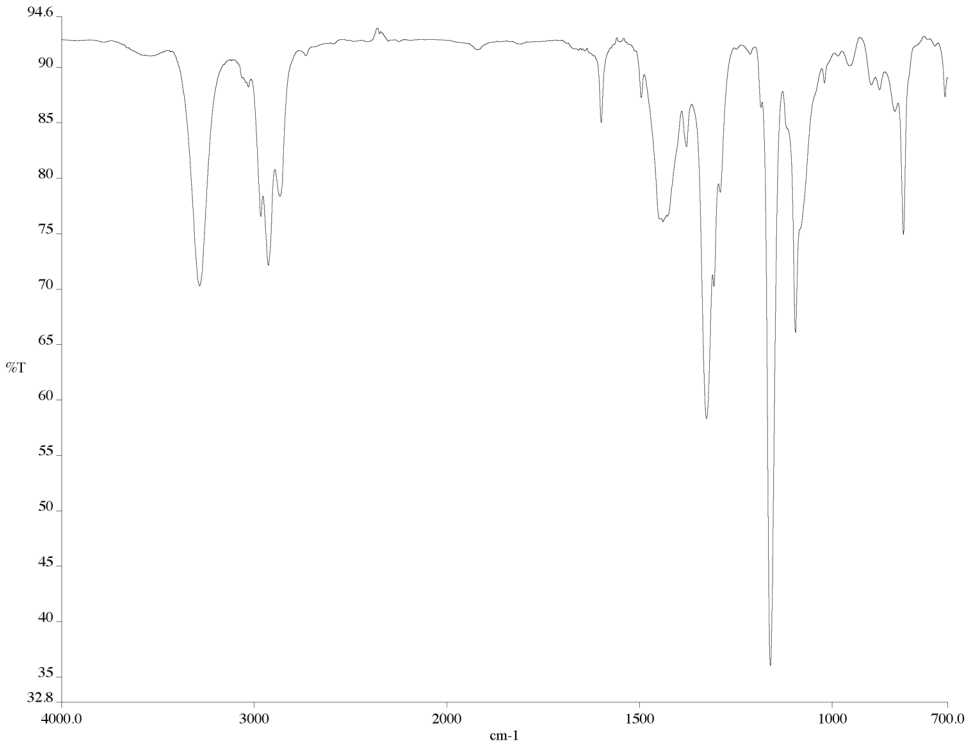


Figure A3.80 Infrared spectrum (thin film/NaCl) of compound **474**.

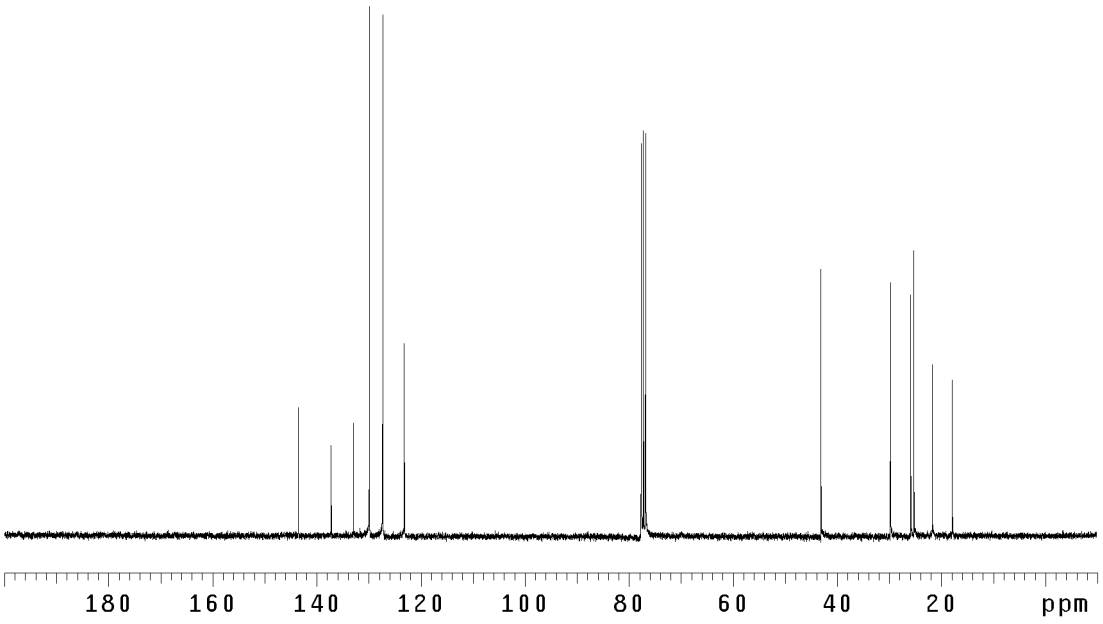


Figure A3.81 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **474**.

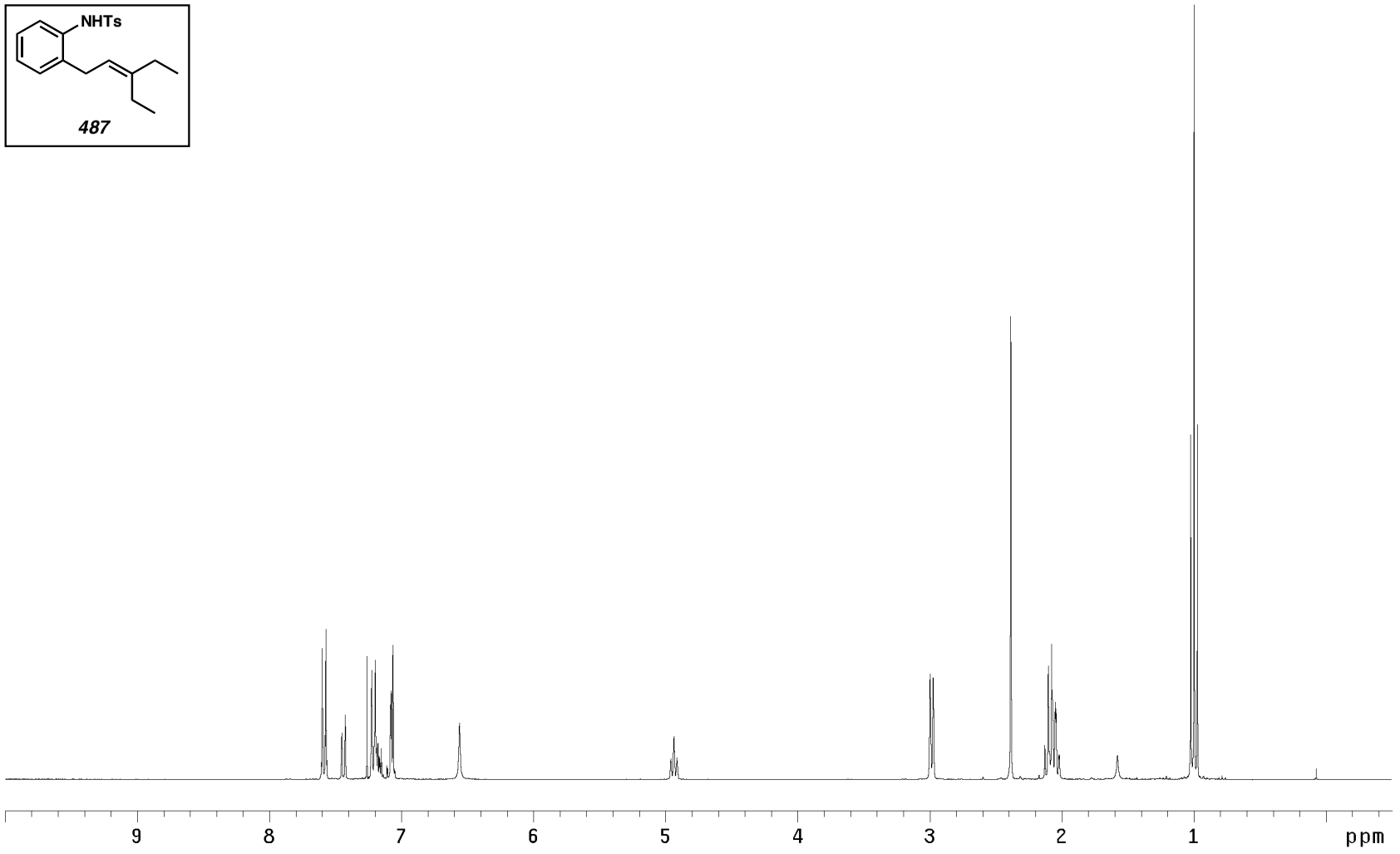


Figure A3.82 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **487**.

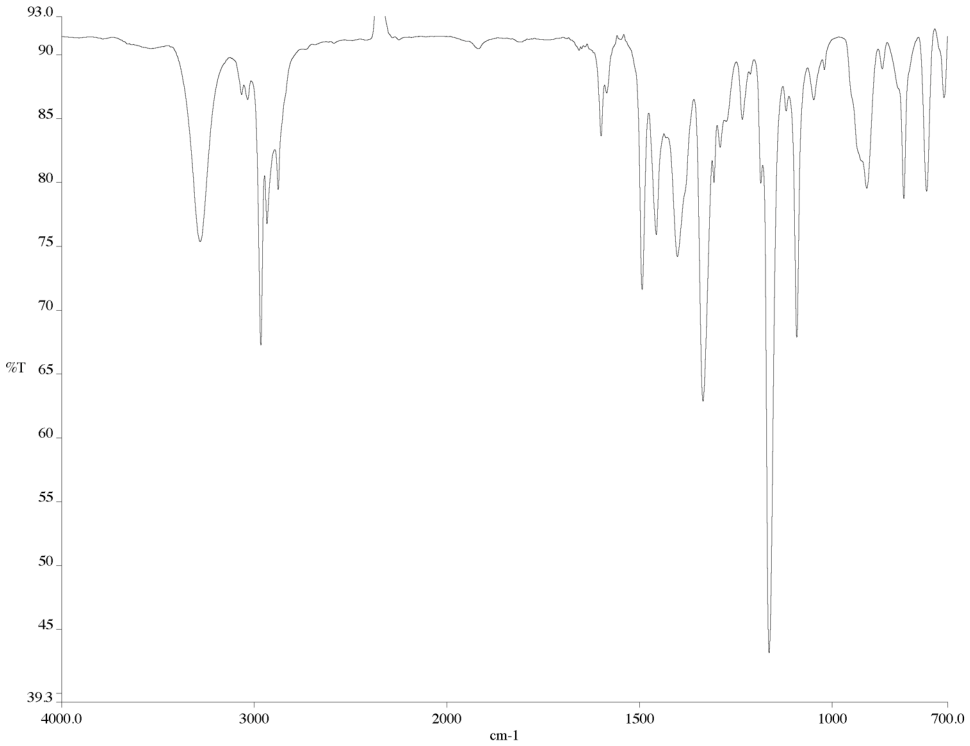


Figure A3.83 Infrared spectrum (thin film/NaCl) of compound **487**.

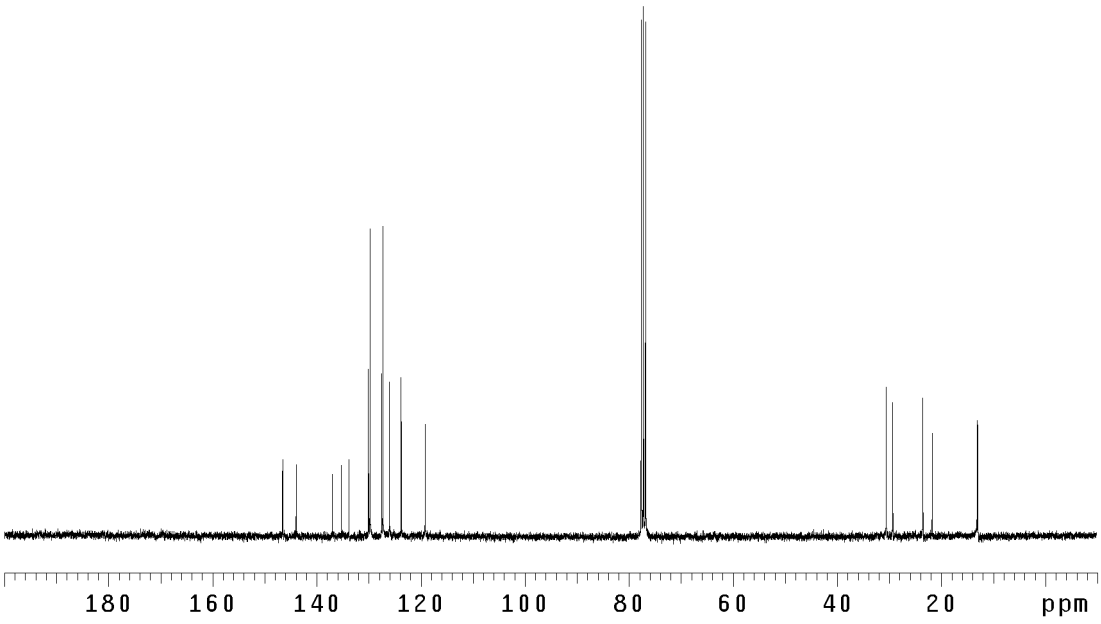


Figure A3.84 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **487**.

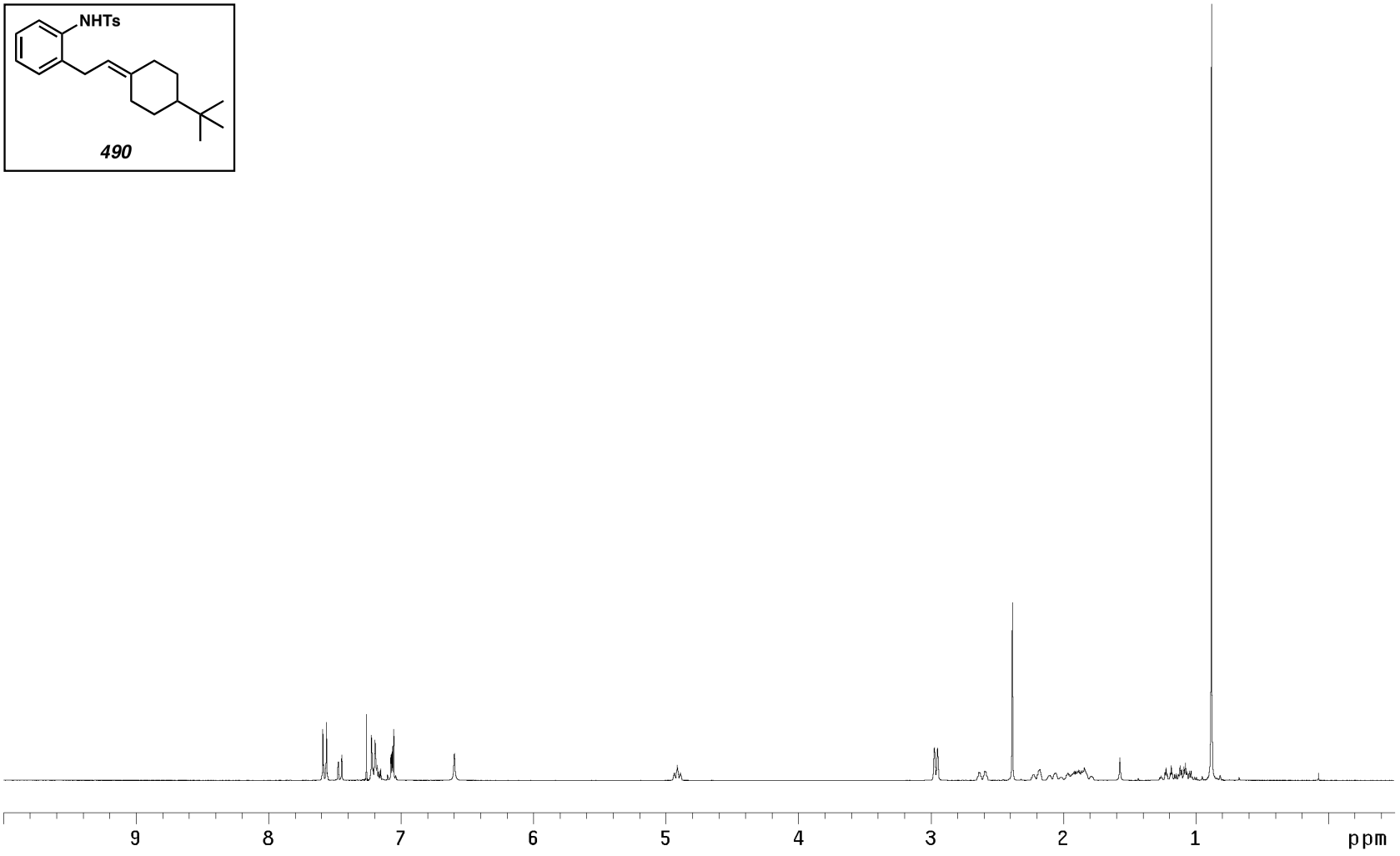


Figure A3.85 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **490**.

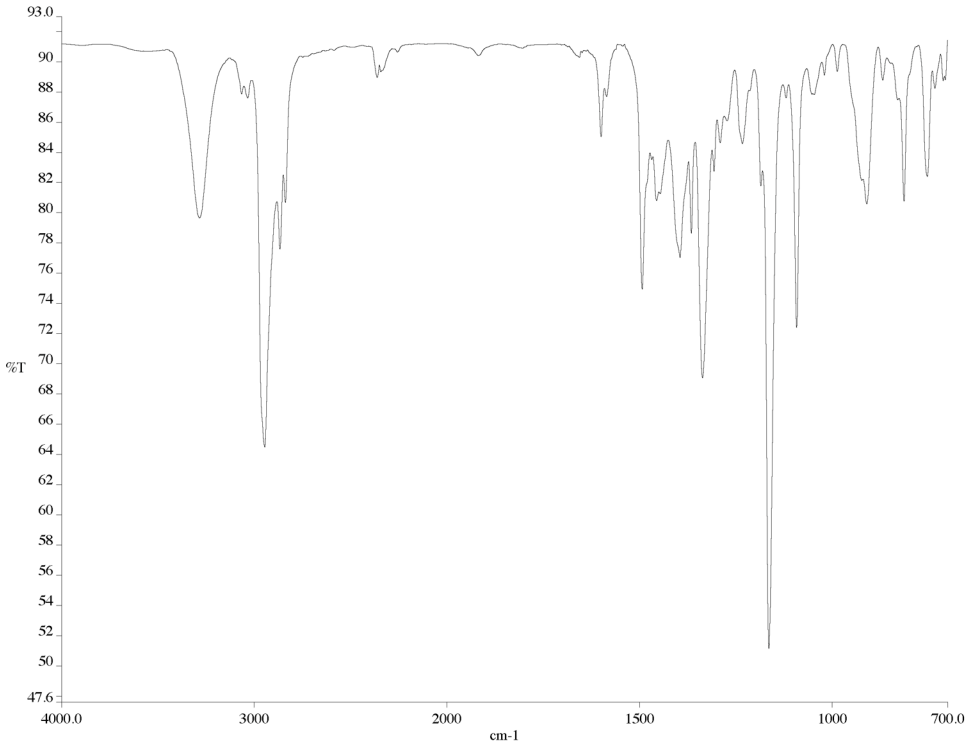


Figure A3.86 Infrared spectrum (thin film/NaCl) of compound **490**.

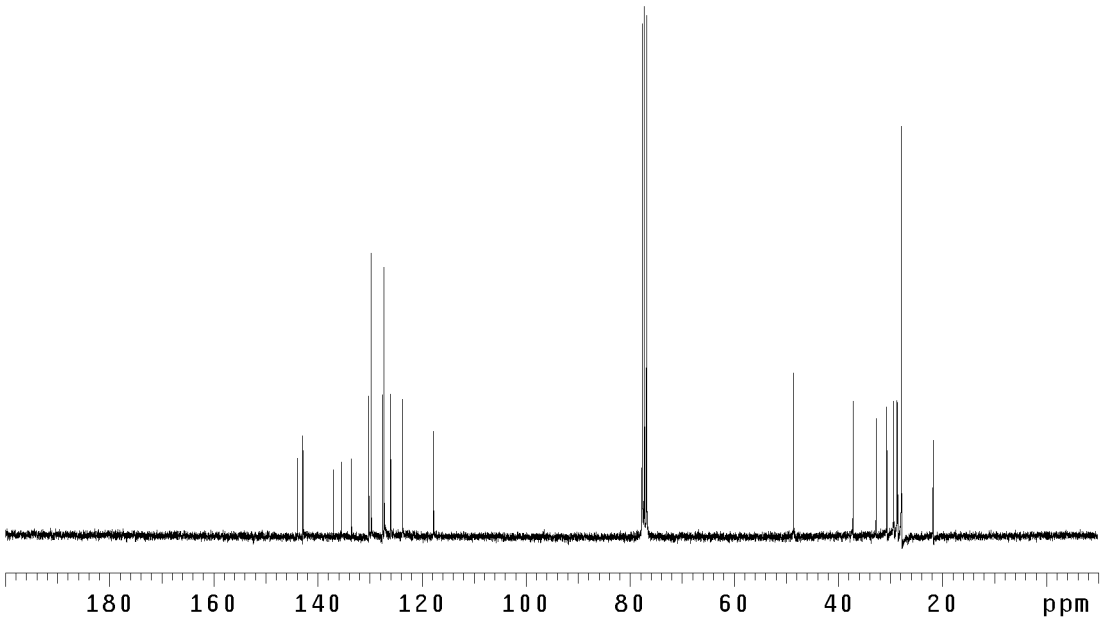


Figure A3.87 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **490**.

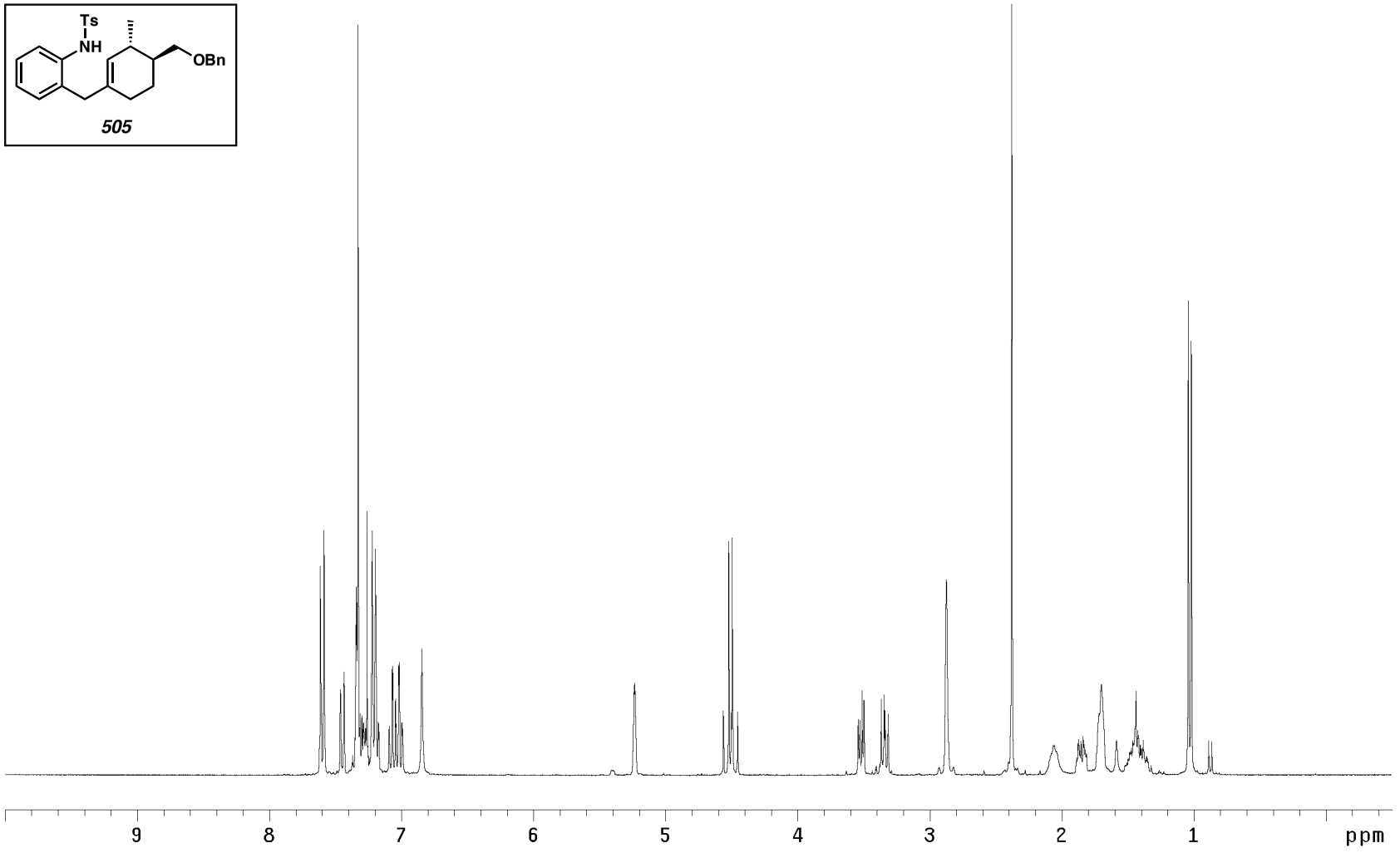


Figure A3.88 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **505**.

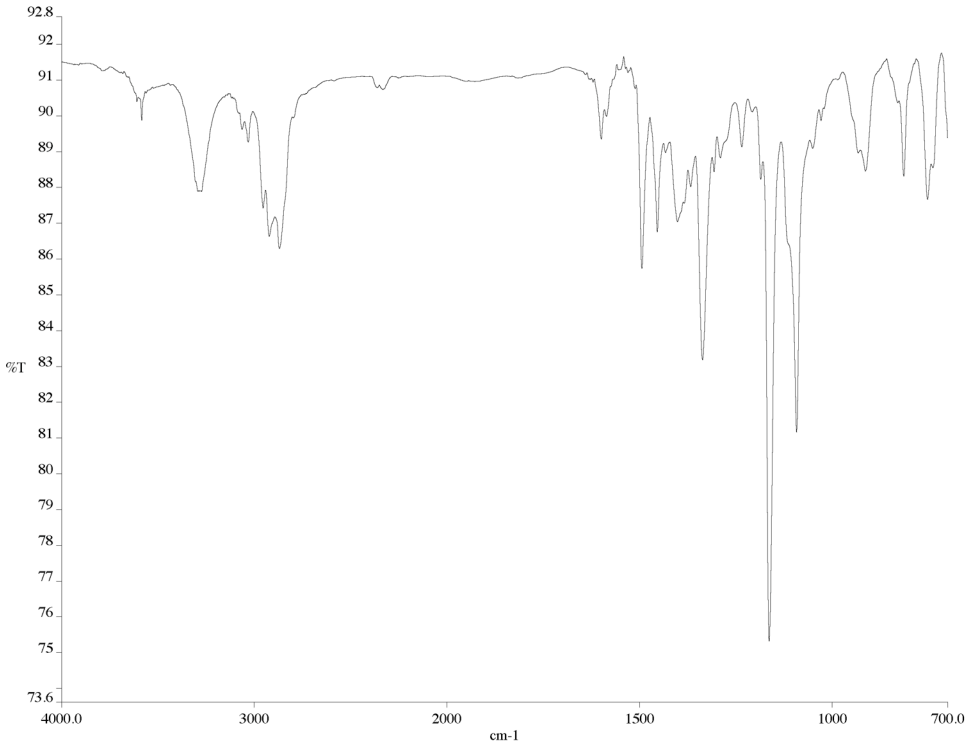


Figure A3.89 Infrared spectrum (thin film/NaCl) of compound **505**.

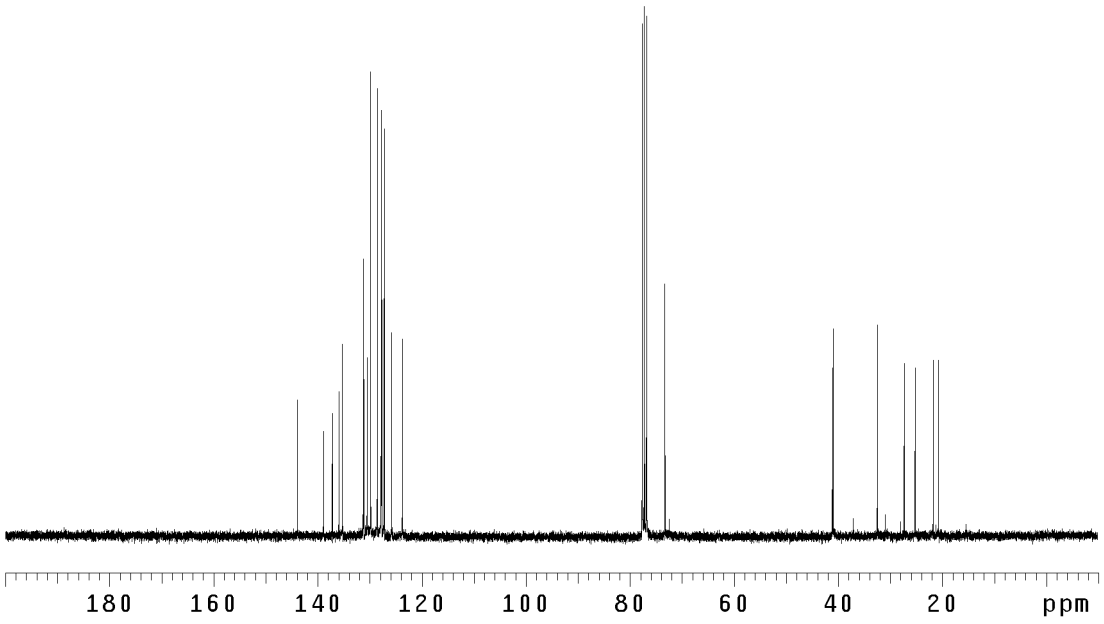


Figure A3.90 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **505**.

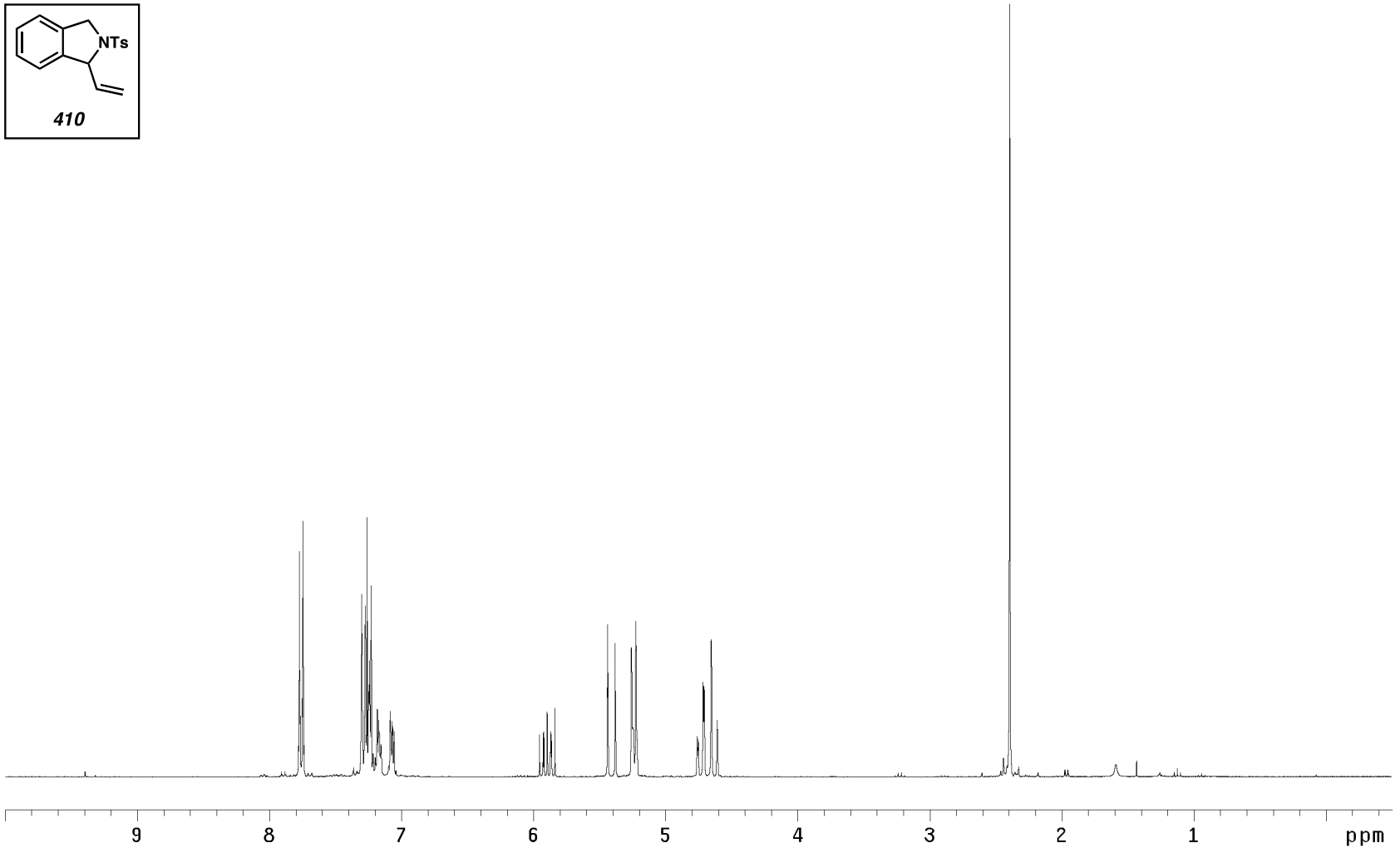


Figure A3.91 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **410**.

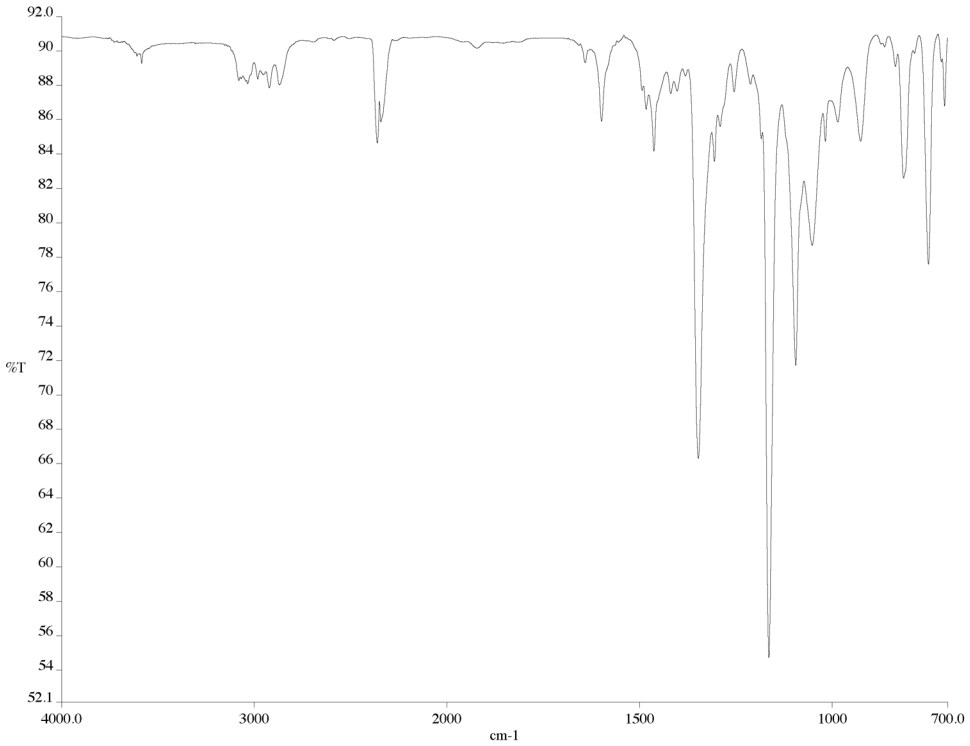


Figure A3.92 Infrared spectrum (thin film/NaCl) of compound **410**.

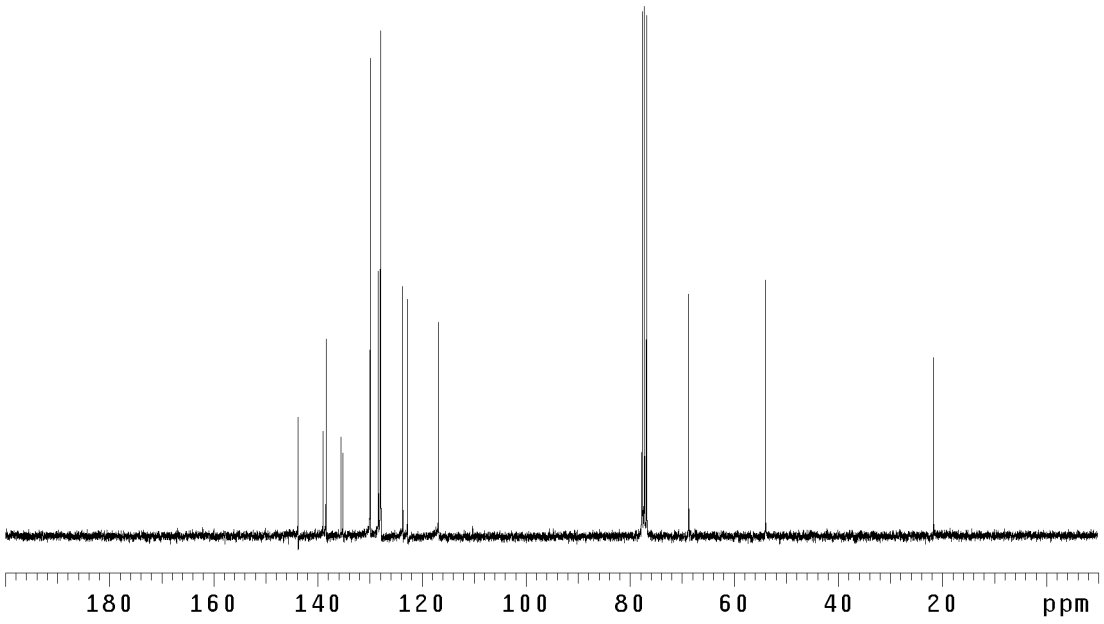


Figure A3.93 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **410**.

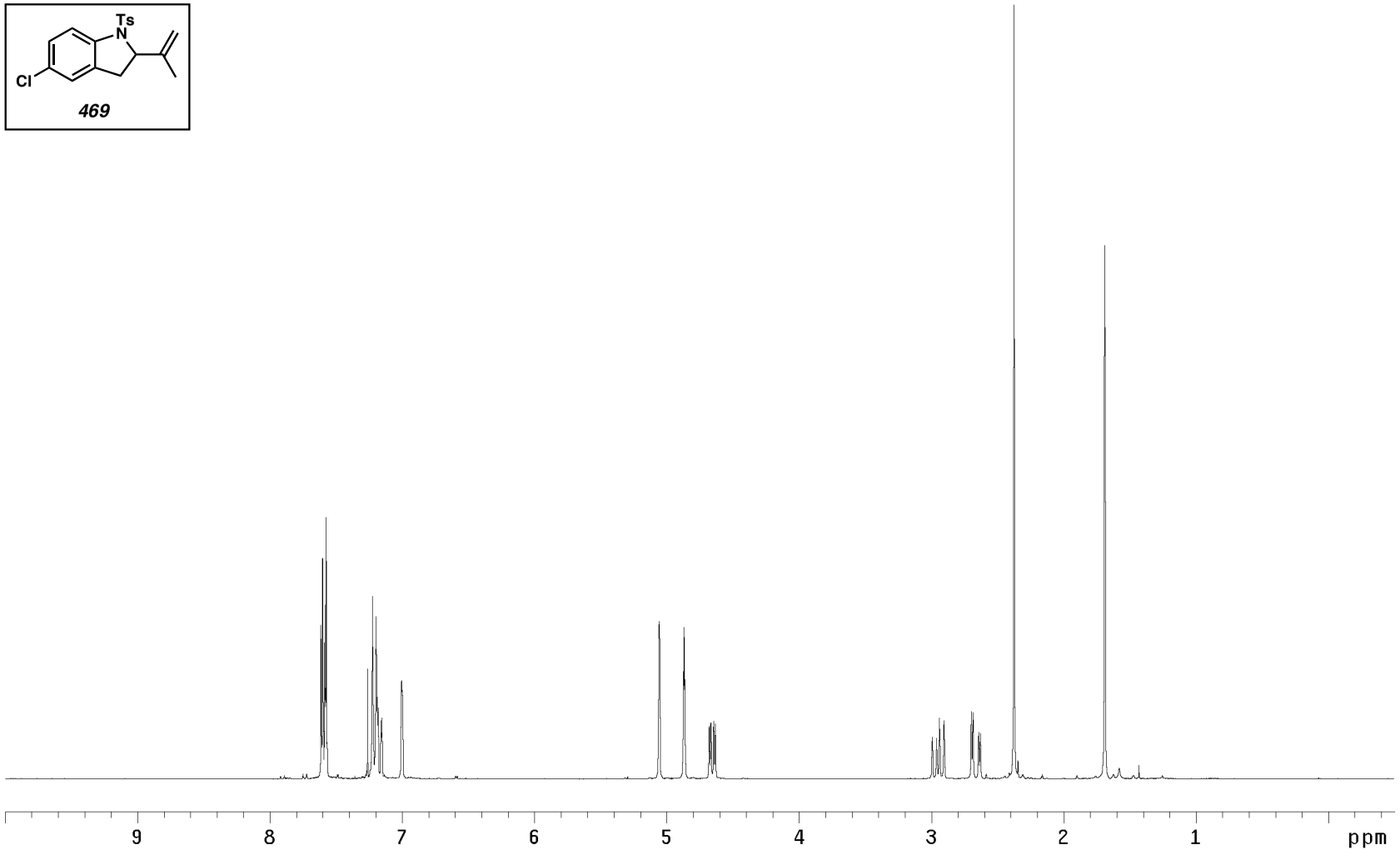


Figure A3.94 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **469**.

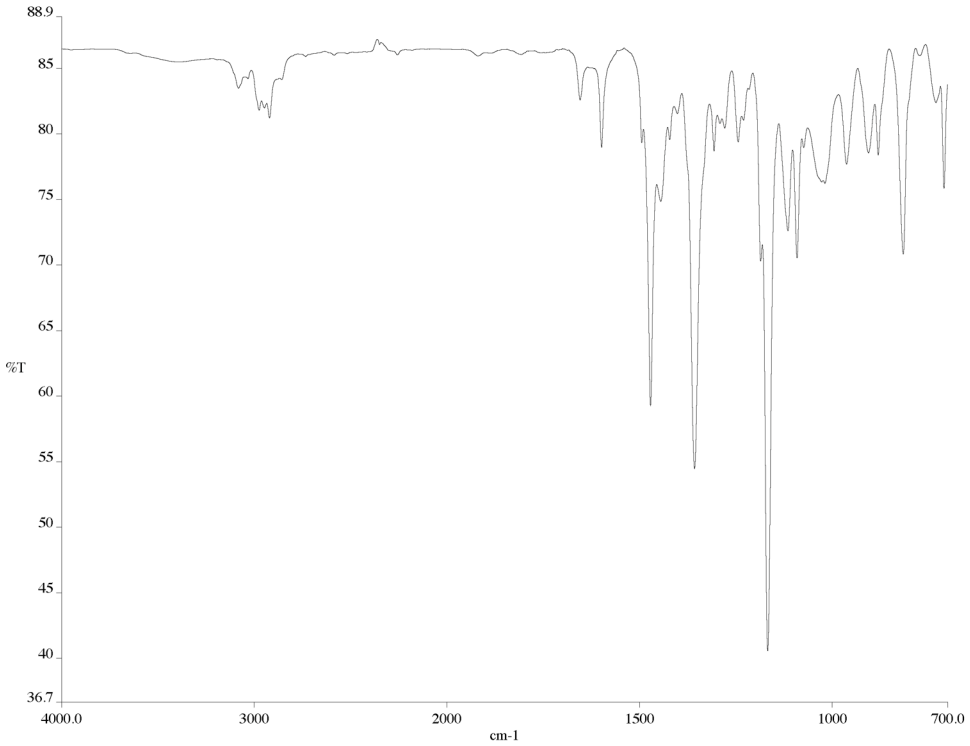


Figure A3.95 Infrared spectrum (thin film/NaCl) of compound **469**.

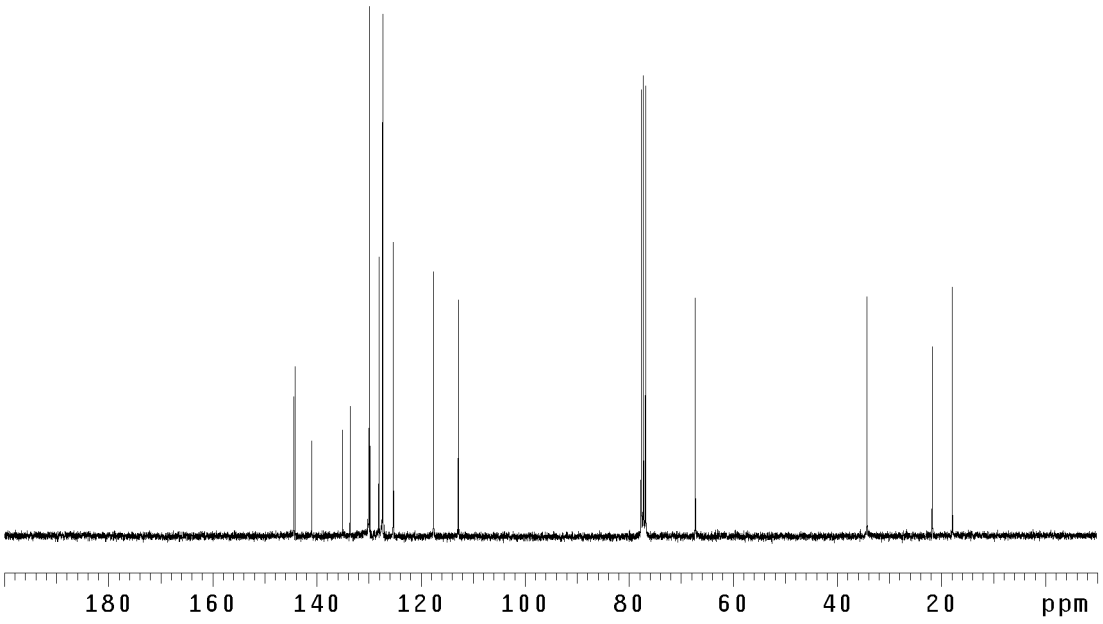
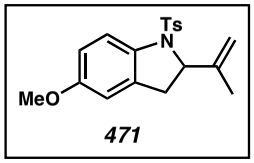


Figure A3.96 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **469**.



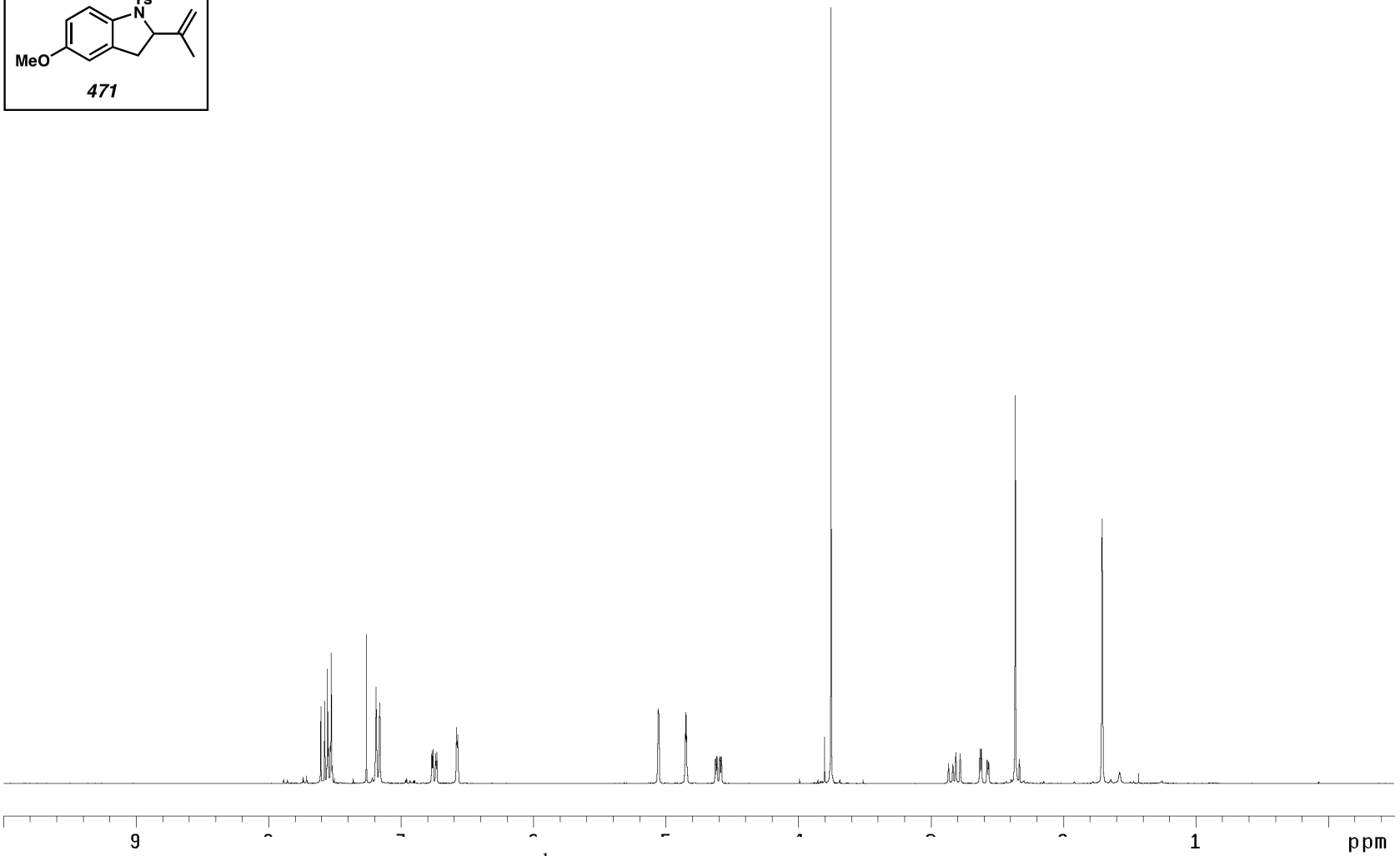


Figure A3.97 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **471**.

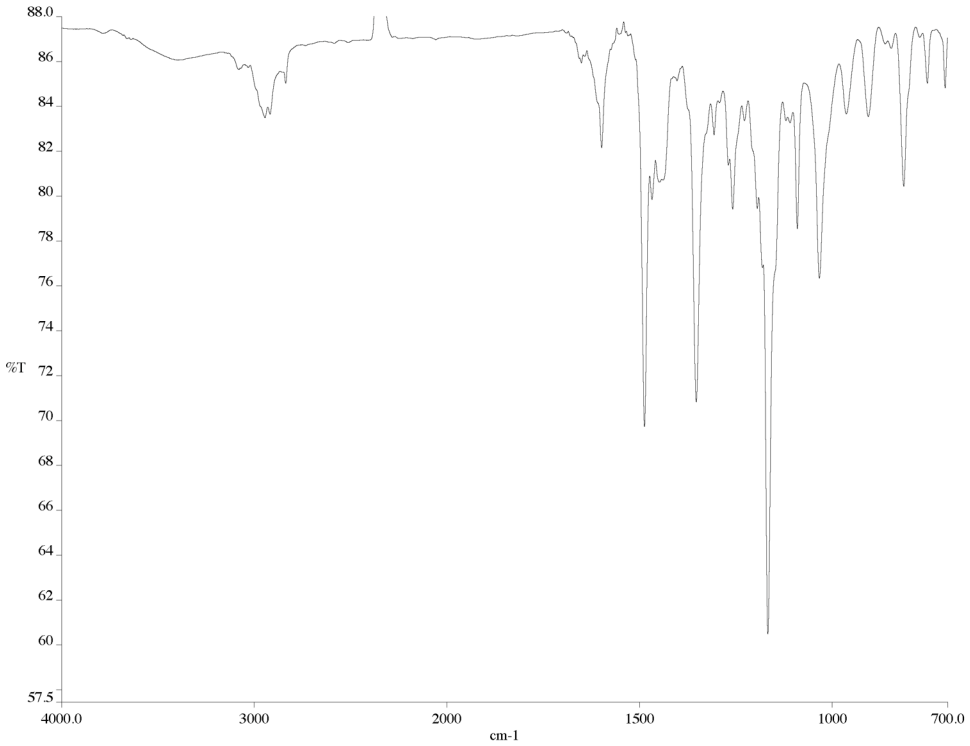


Figure A3.98 Infrared spectrum (thin film/NaCl) of compound **471**.

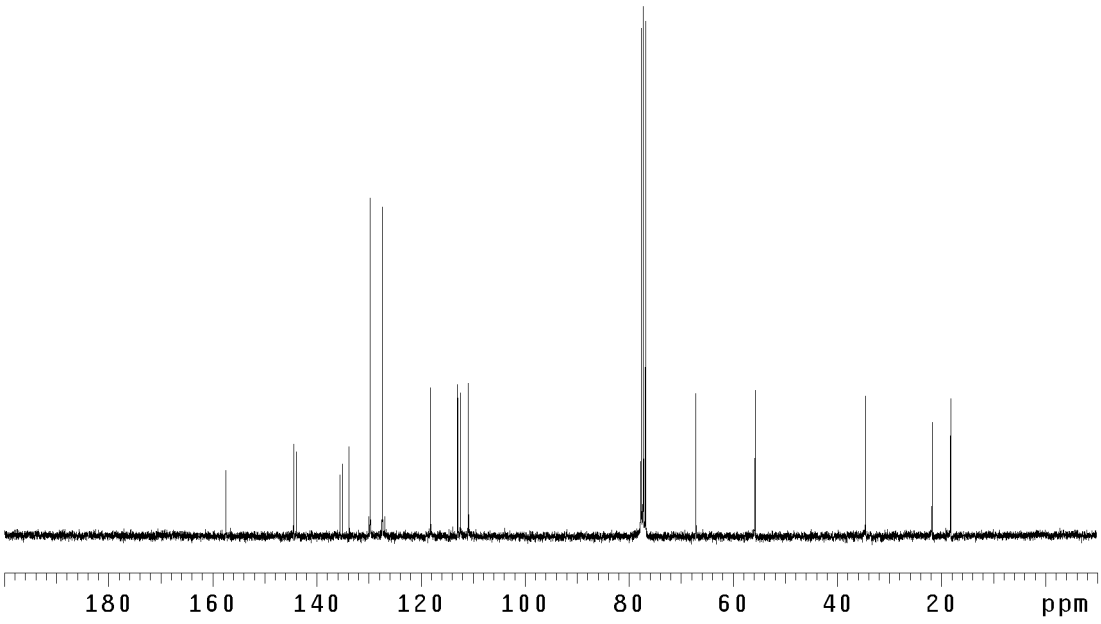


Figure A3.99 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **471**.

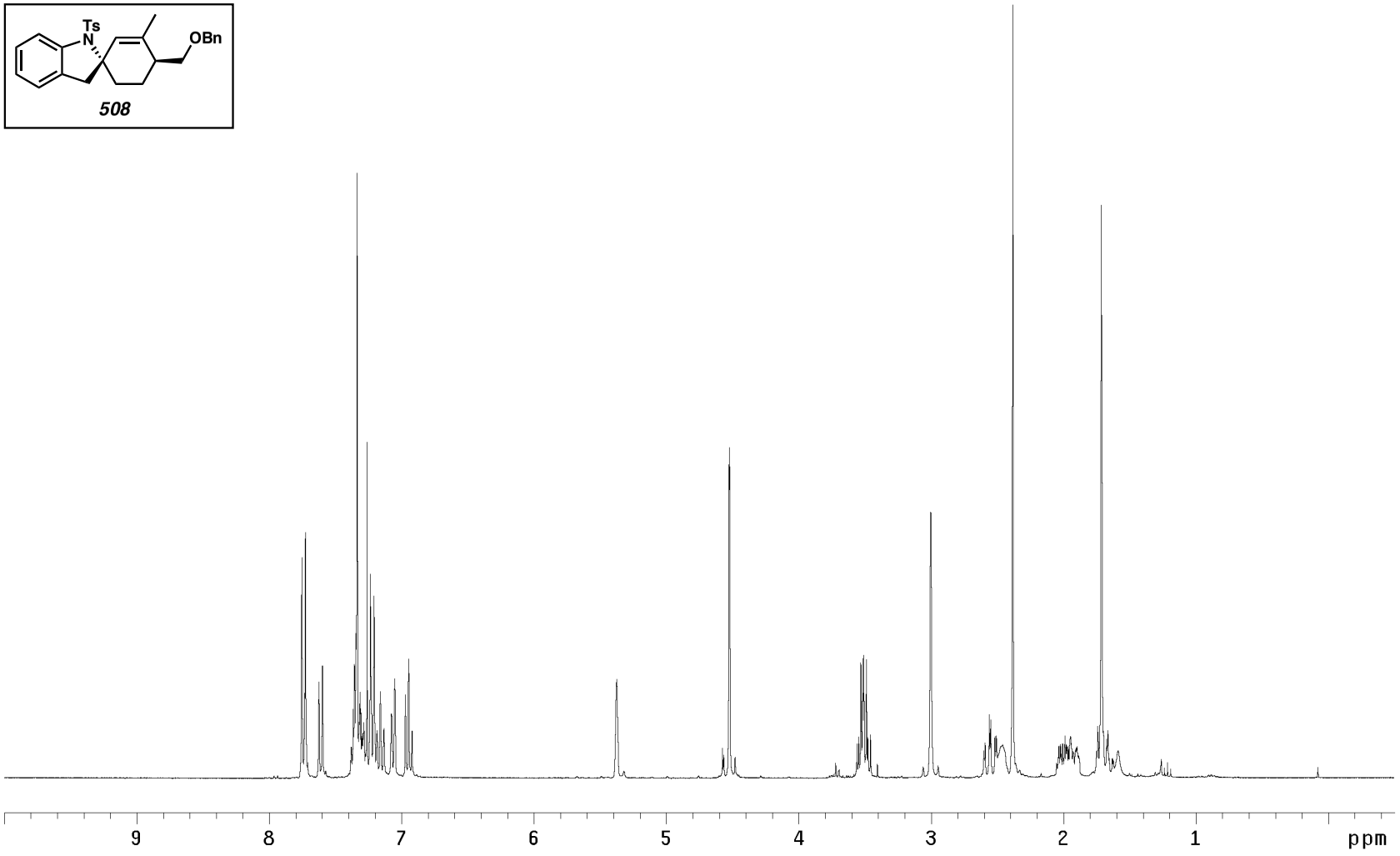


Figure A3.100 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **508**.

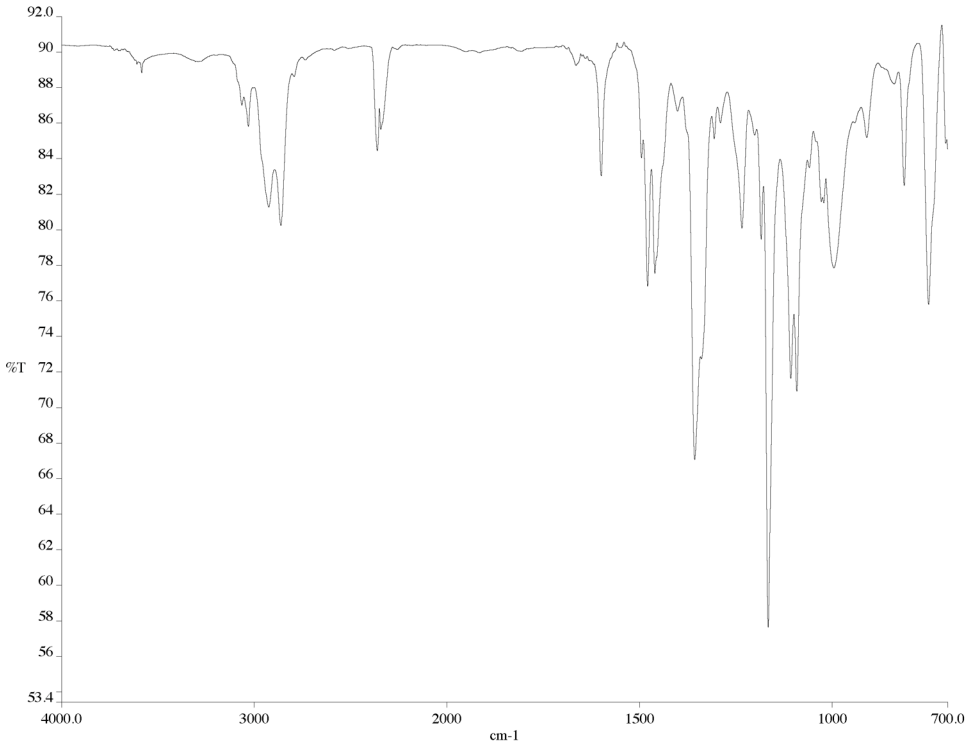


Figure A3.101 Infrared spectrum (thin film/NaCl) of compound **508**.

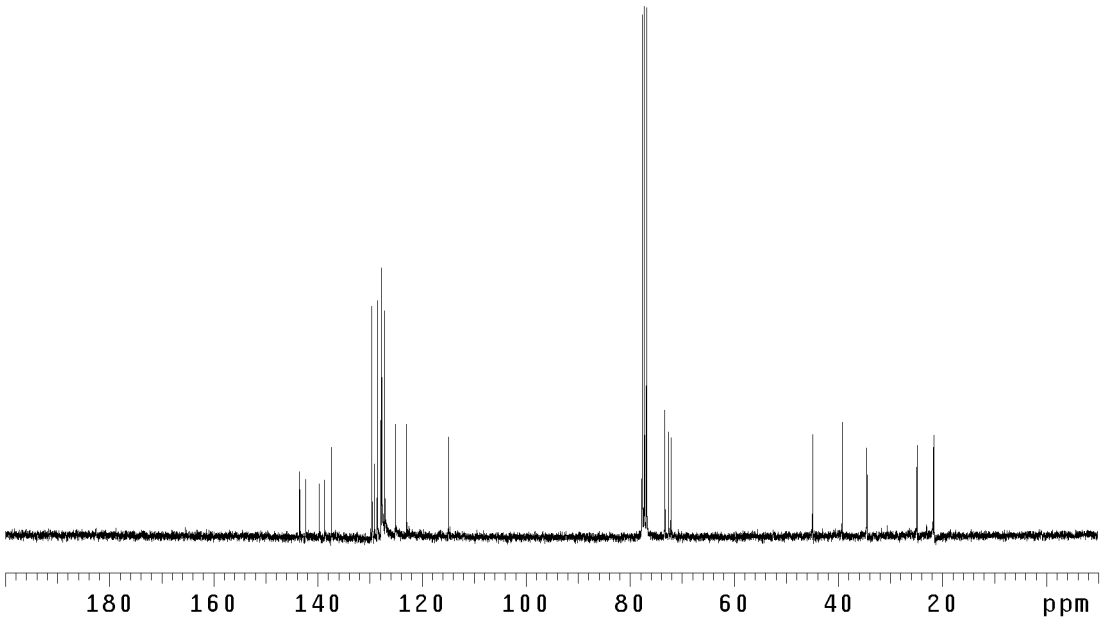


Figure A3.102 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **508**.

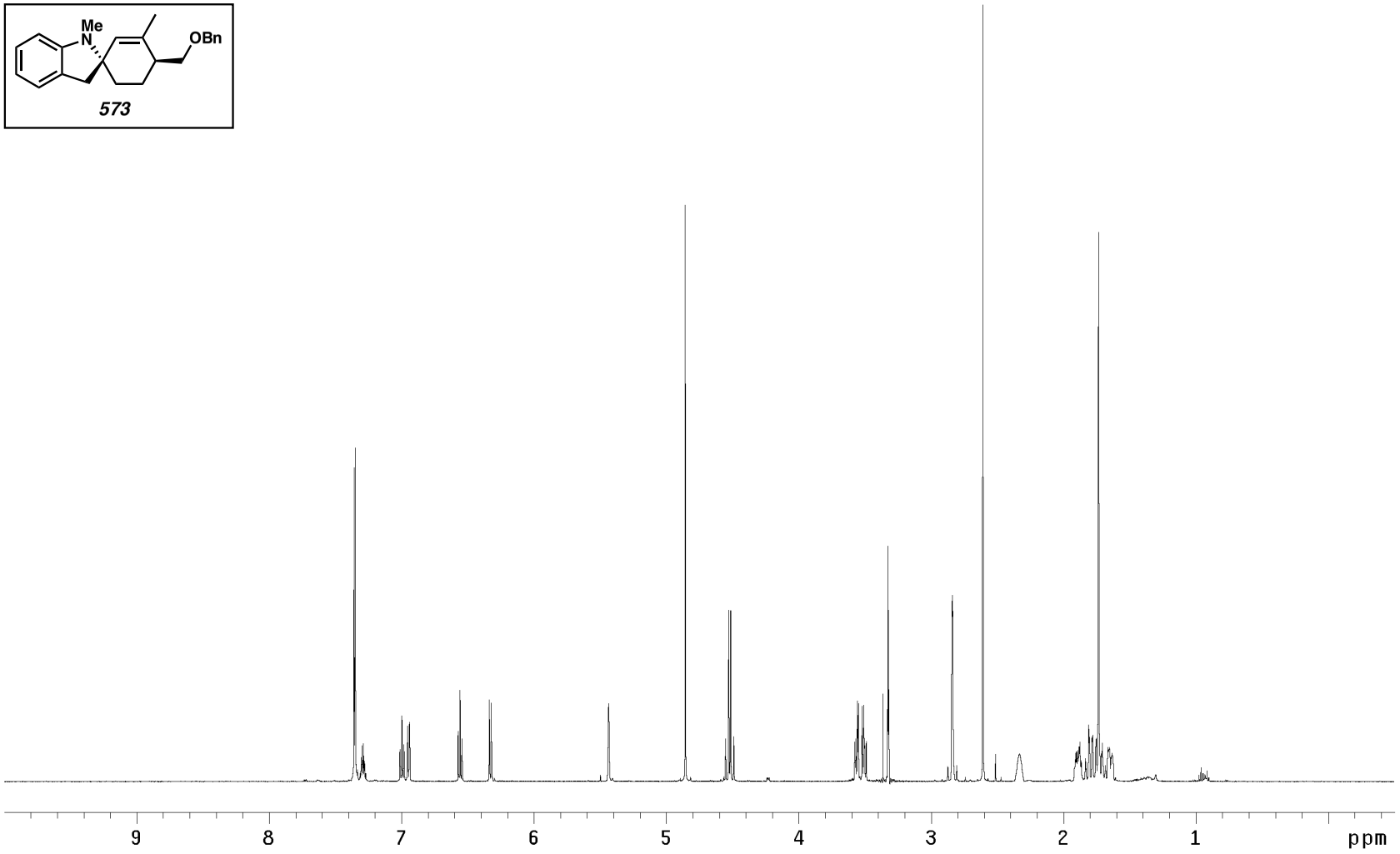


Figure A3.103 ^{1}H NMR (500 MHz, CD_3OD) of compound **573**.

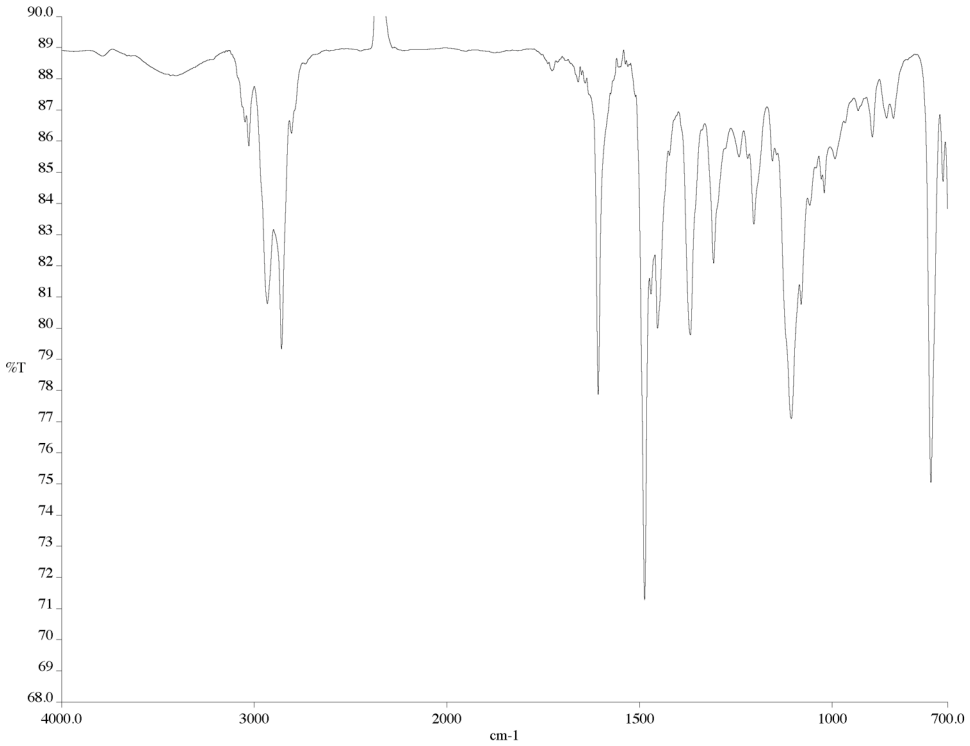


Figure A3.104 Infrared spectrum (thin film/NaCl) of compound **573**.

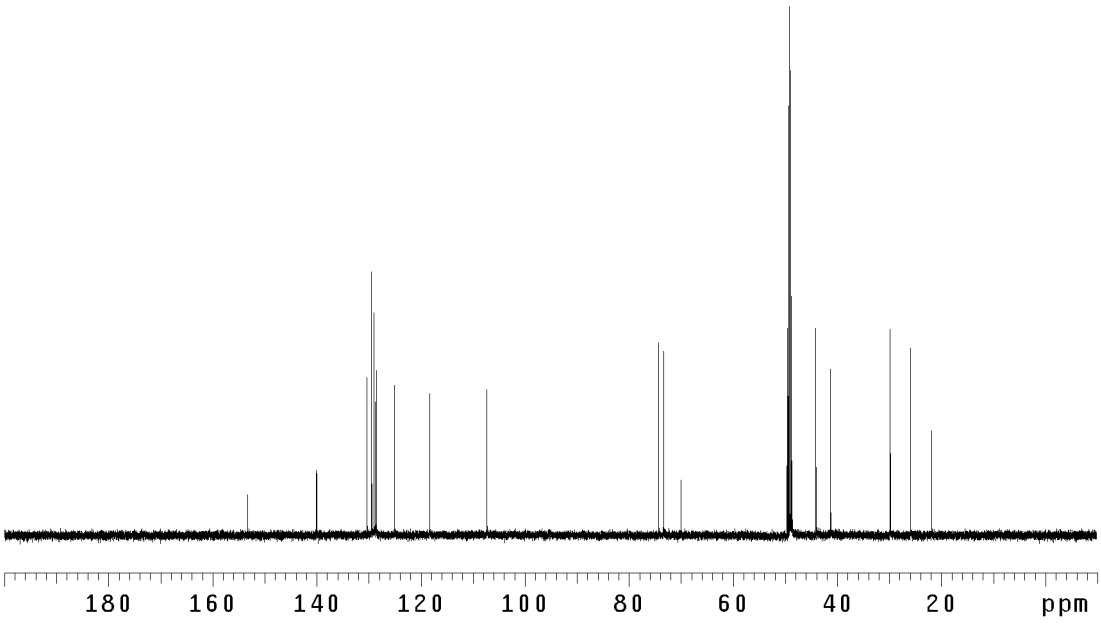


Figure A3.105 ^{13}C NMR (125 MHz, CD_3OD) of compound **573**.

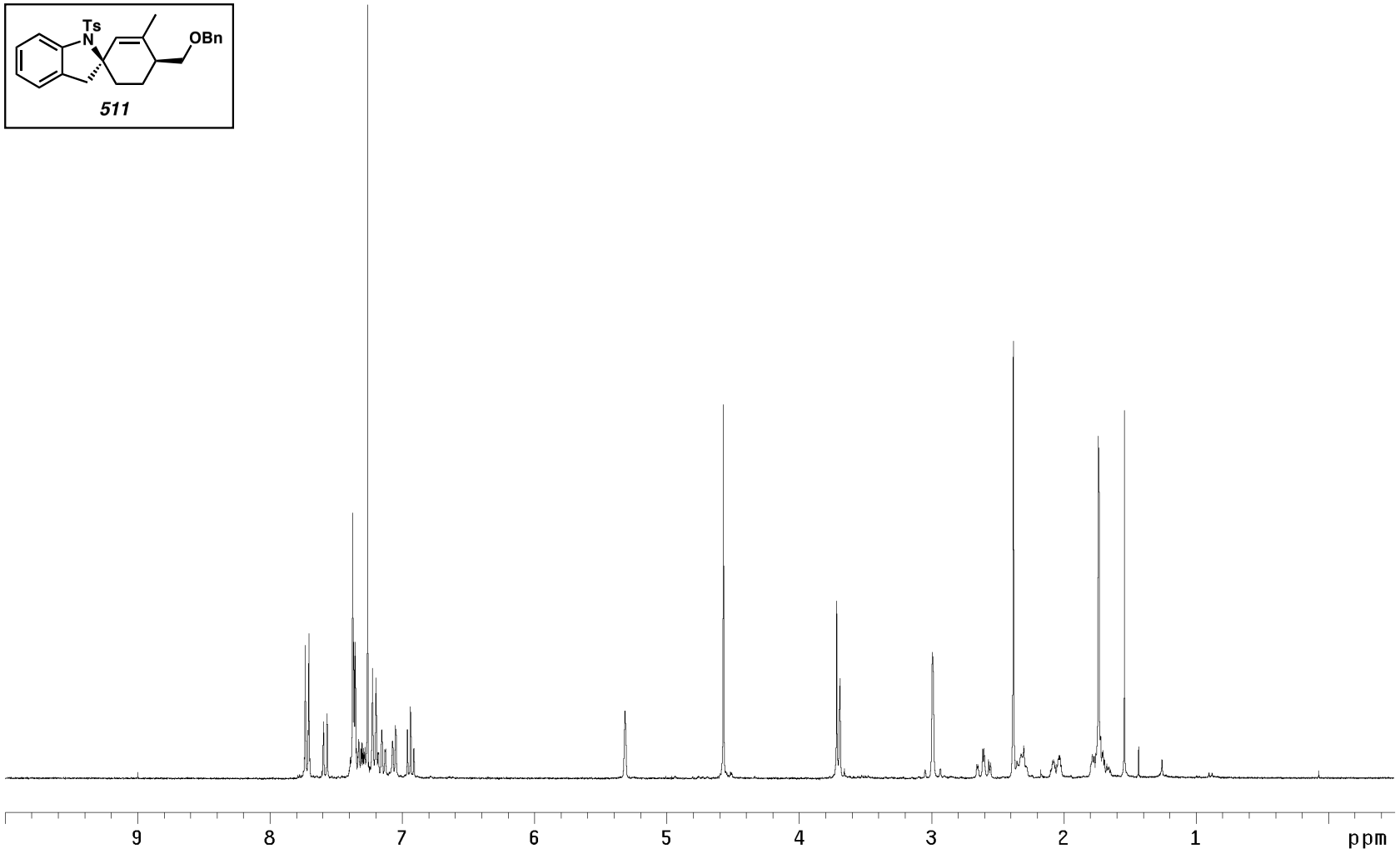


Figure A3.106 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **511**.

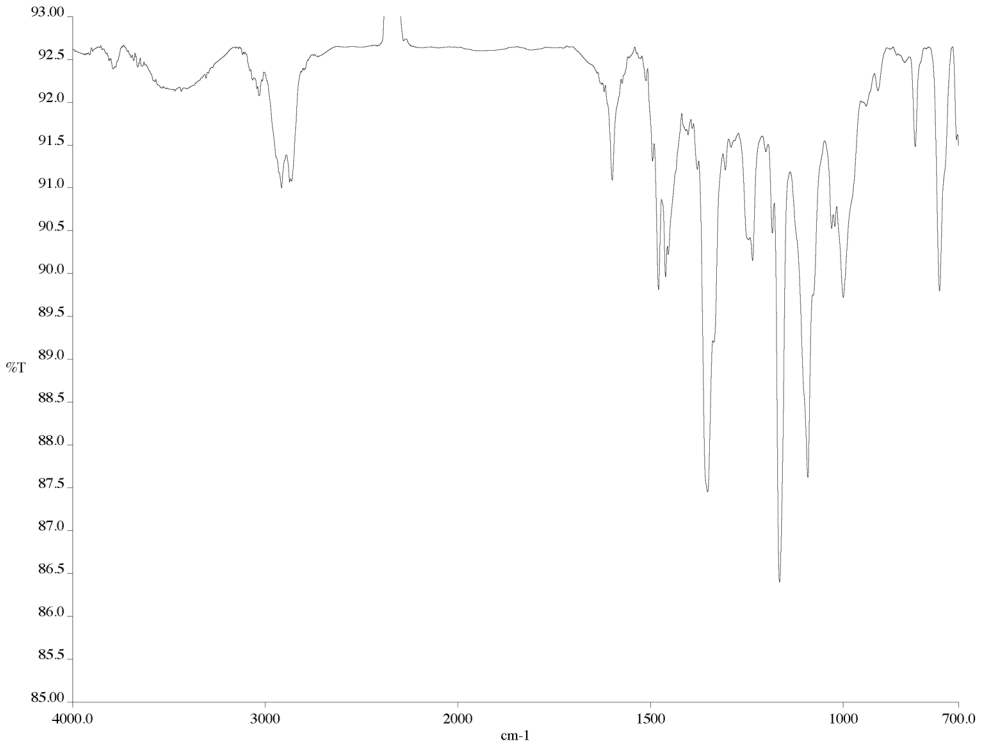


Figure A3.107 Infrared spectrum (thin film/NaCl) of compound **511**.

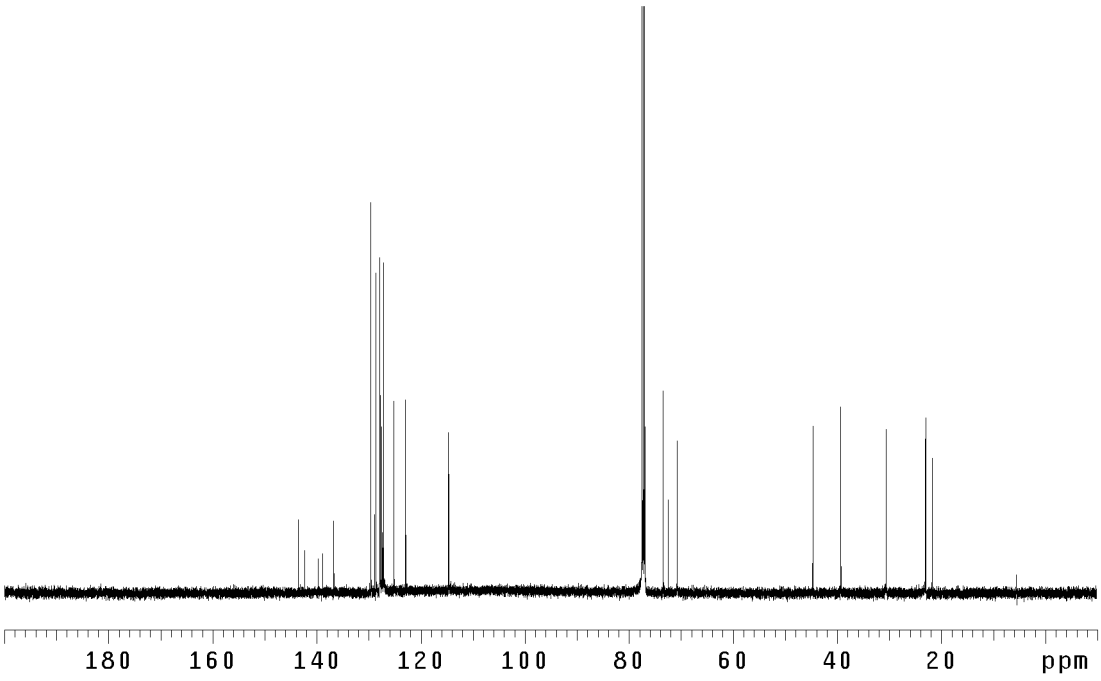


Figure A3.108 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **511**.

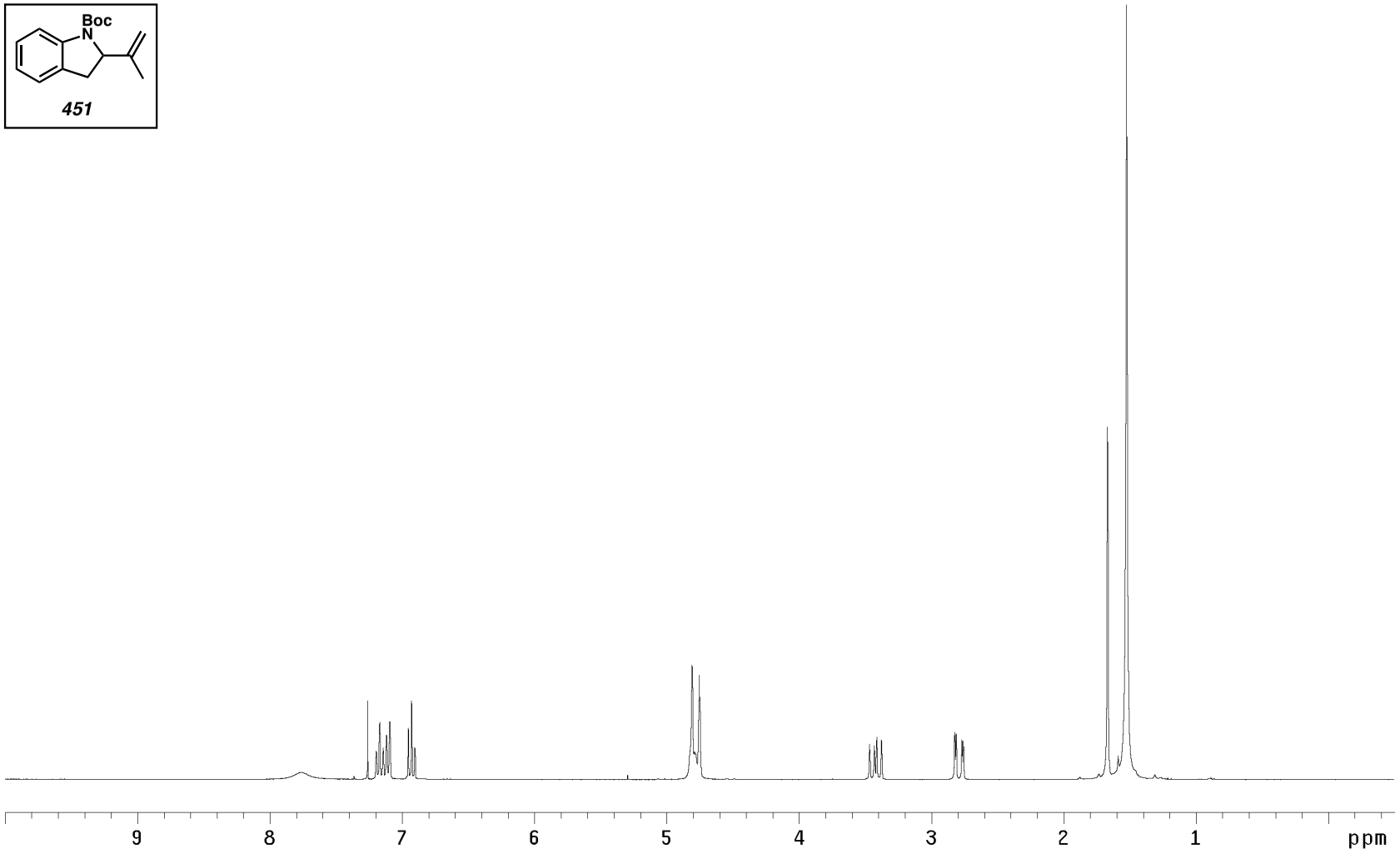


Figure A3.109 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **451**.

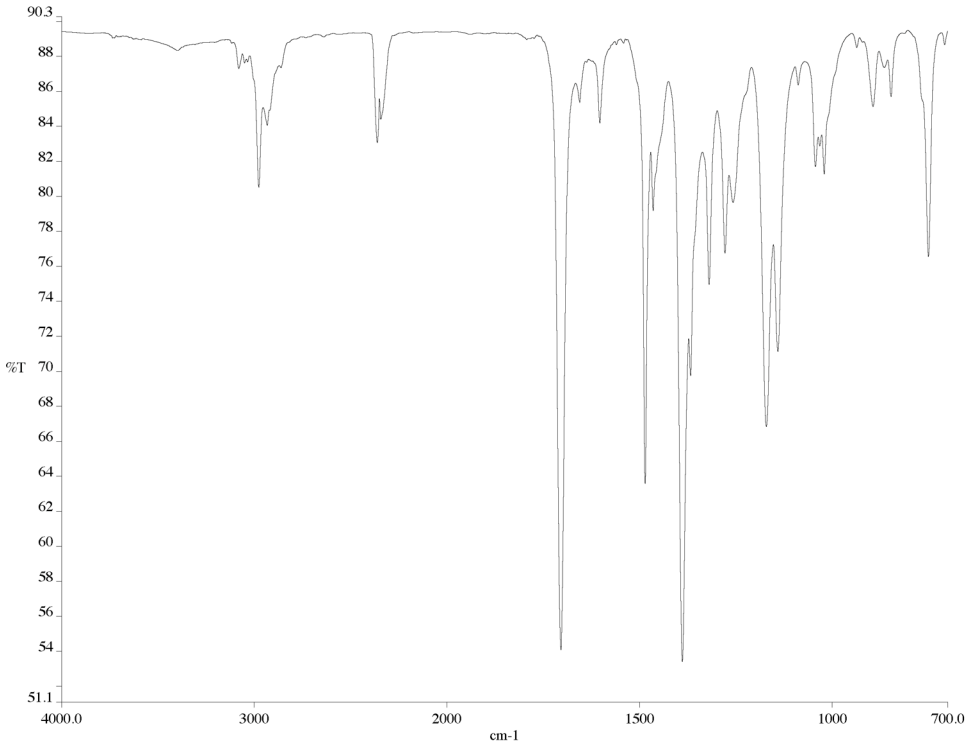


Figure A3.110 Infrared spectrum (thin film/NaCl) of compound **451**.

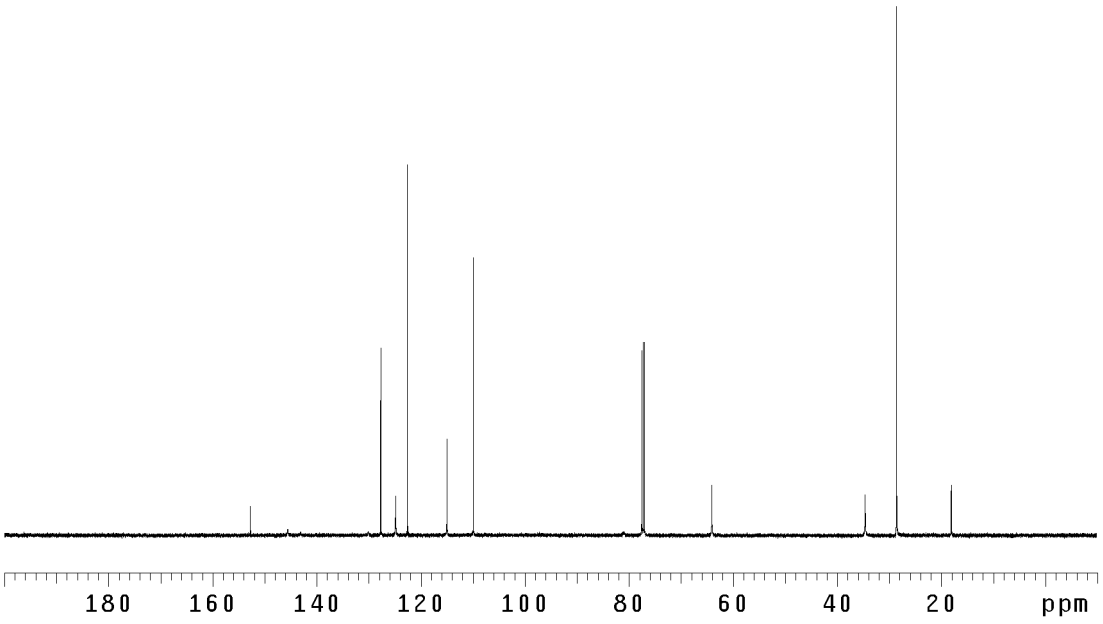


Figure A3.111 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **451**.

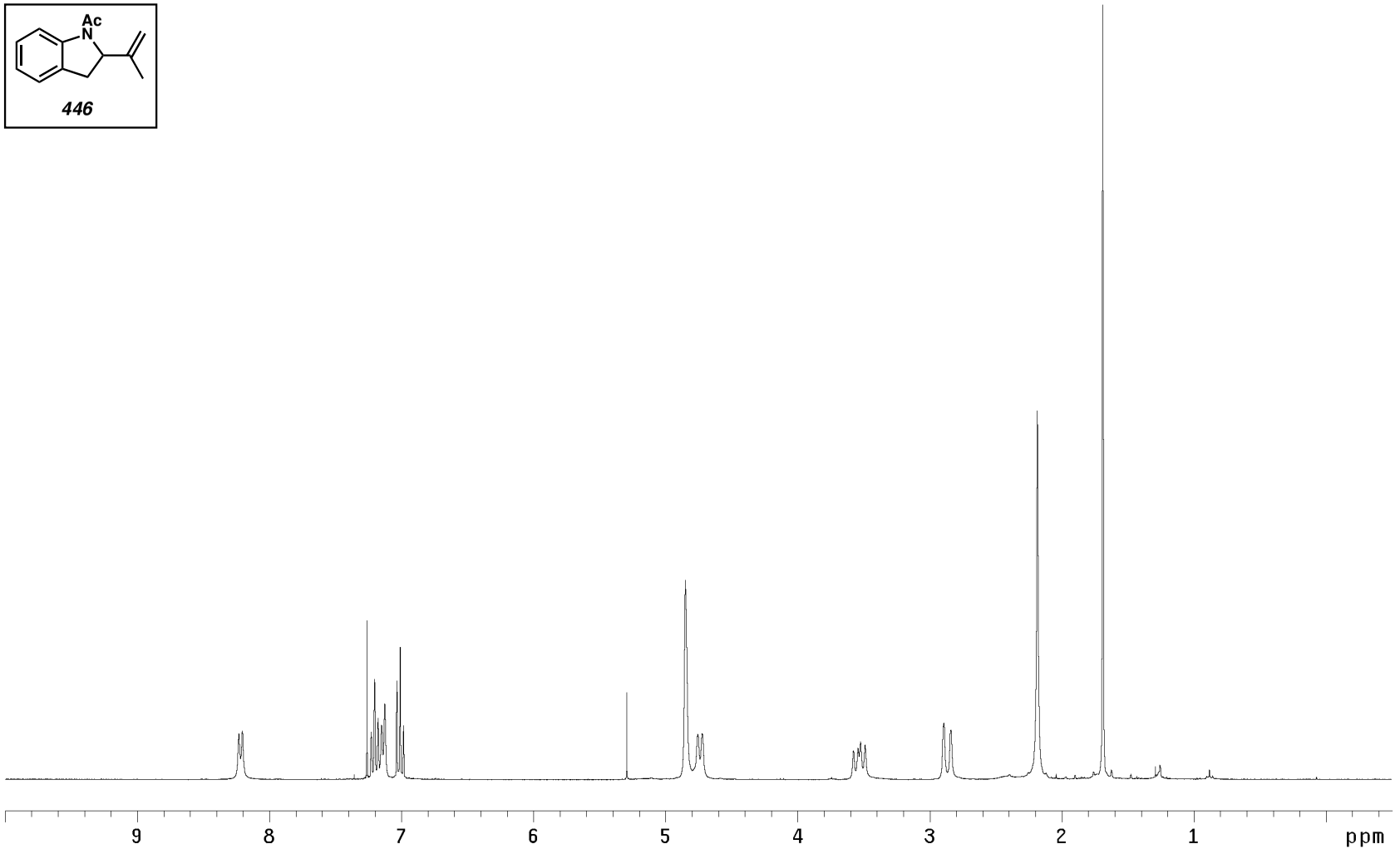


Figure A3.112 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **446**.

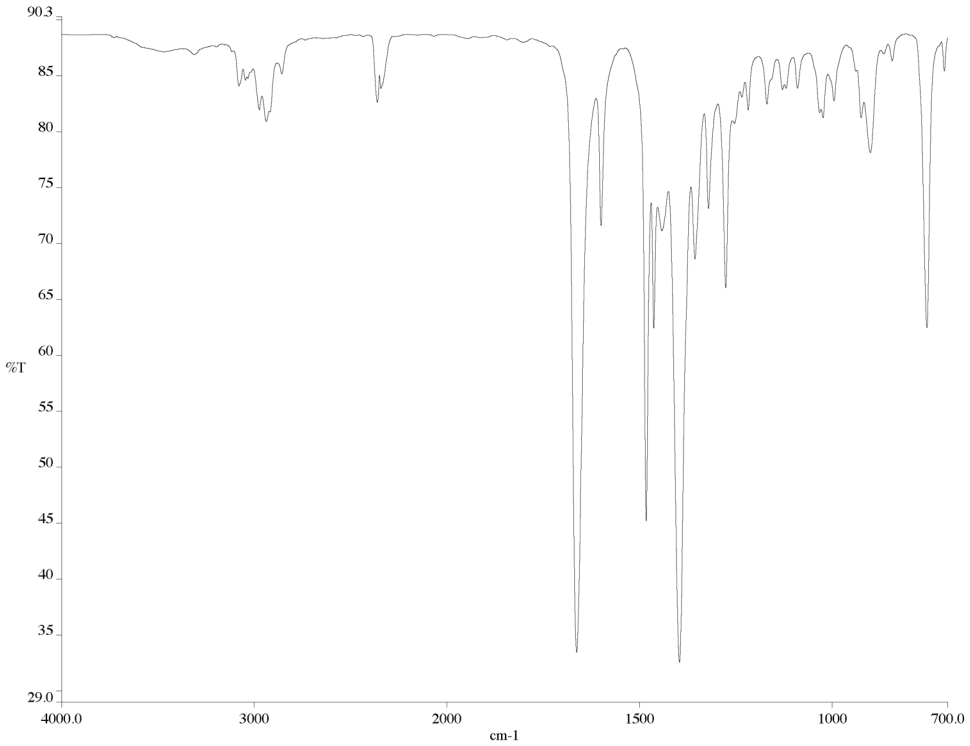


Figure A3.113 Infrared spectrum (thin film/NaCl) of compound **446**.

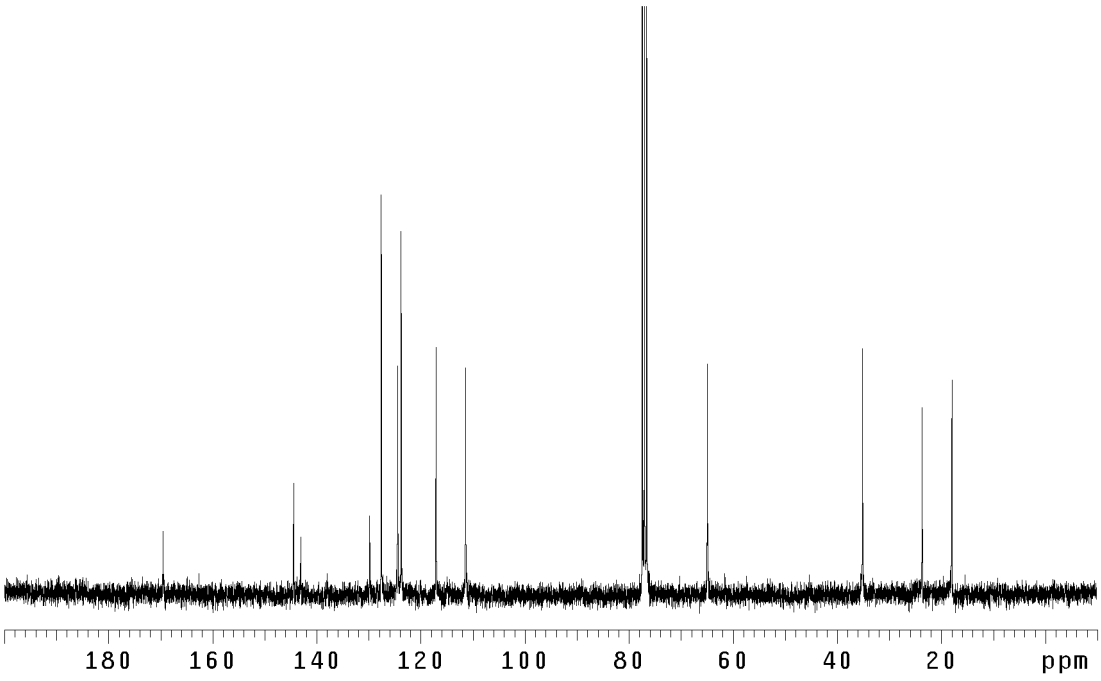


Figure A3.114 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **446**.

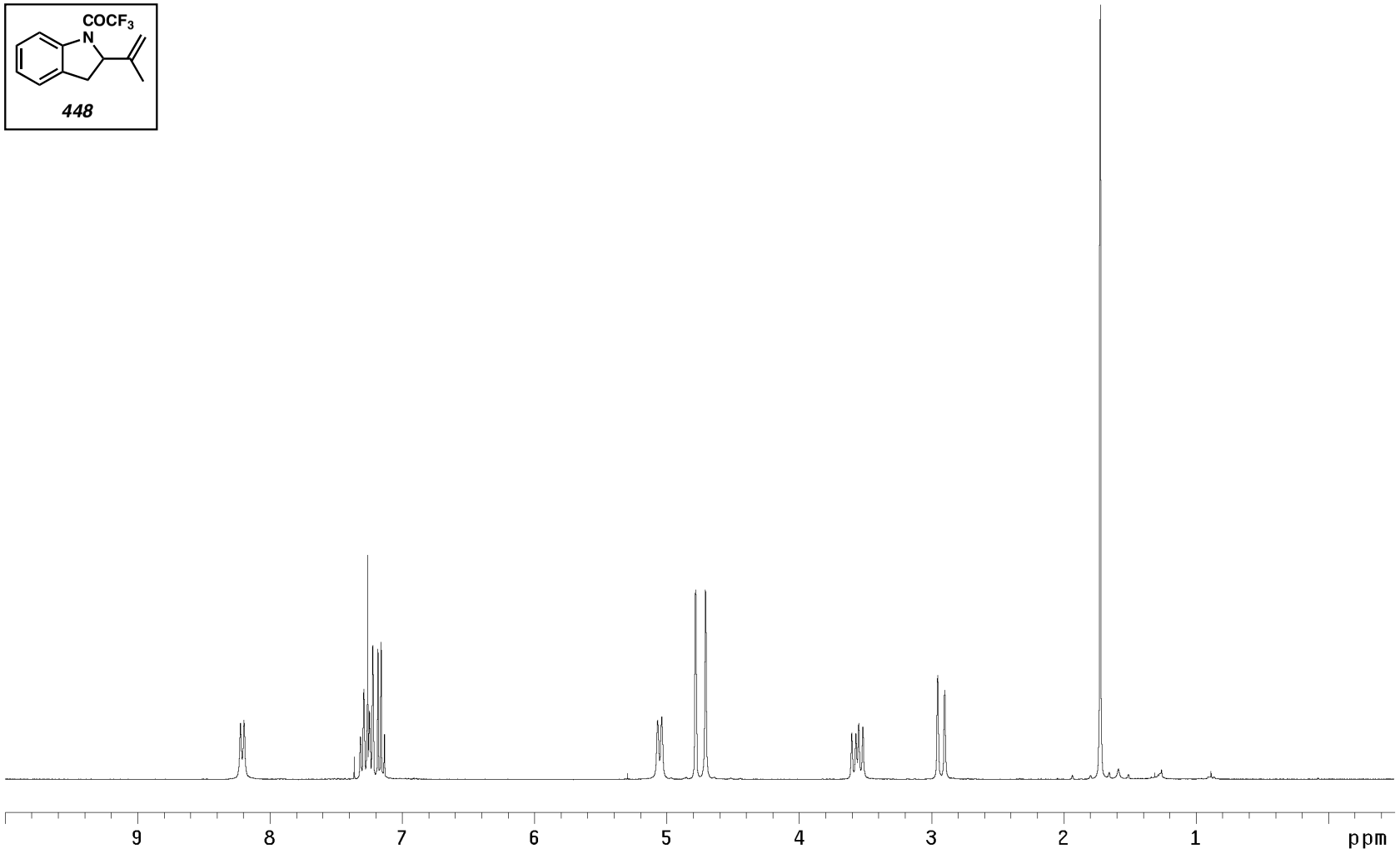


Figure A3.115 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **448**.

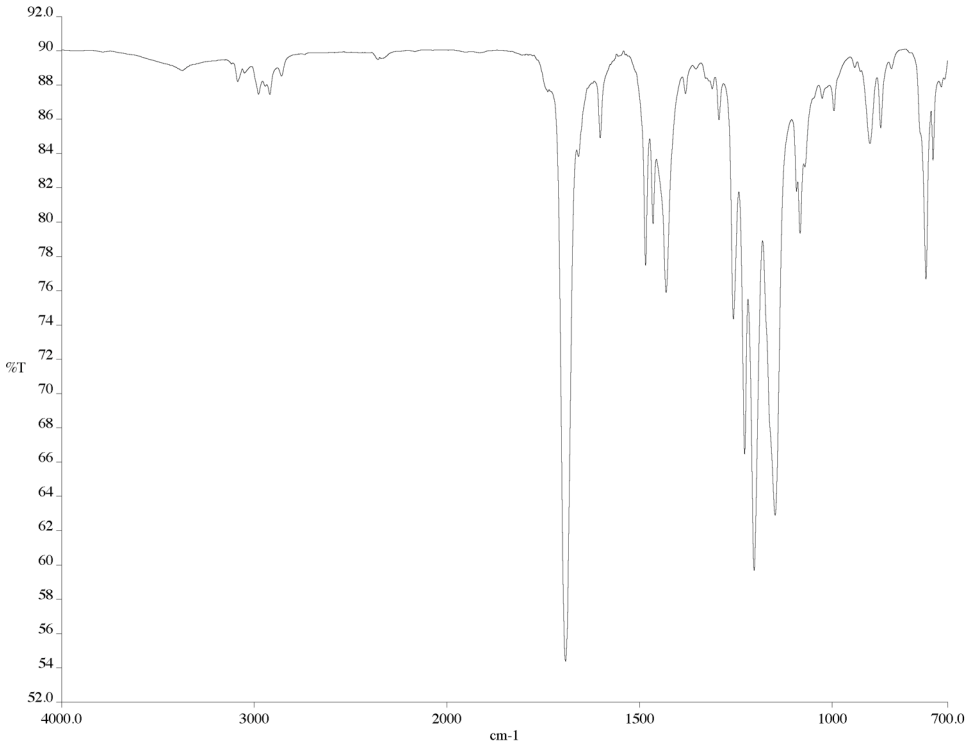


Figure A3.116 Infrared spectrum (thin film/NaCl) of compound **448**.

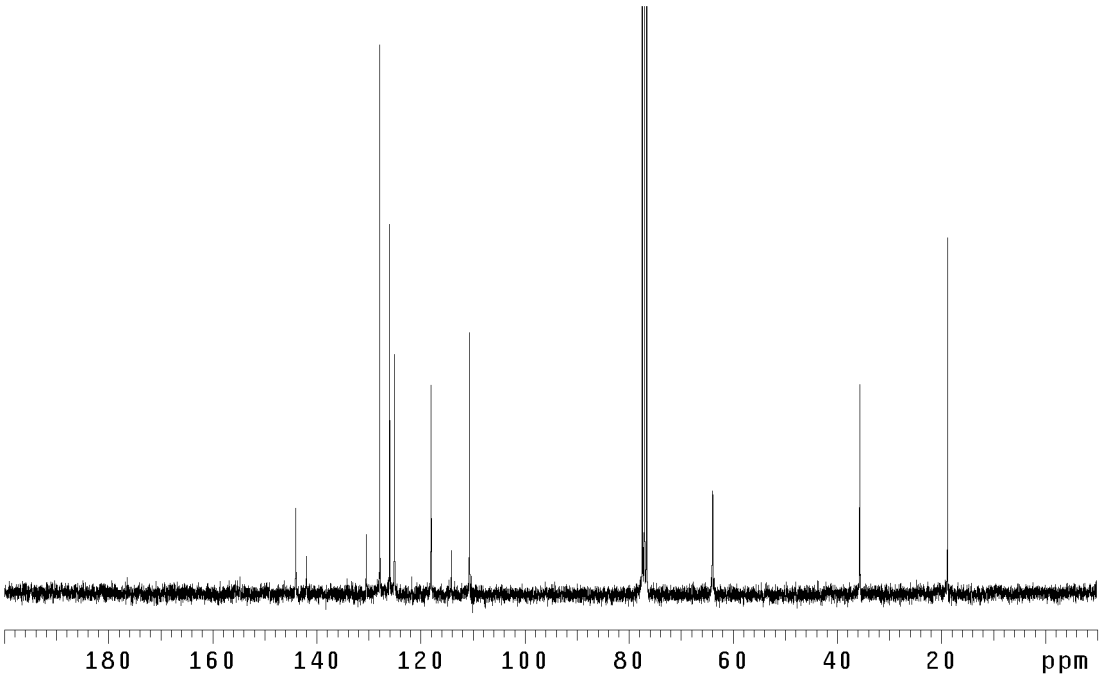


Figure A3.117 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **448**.

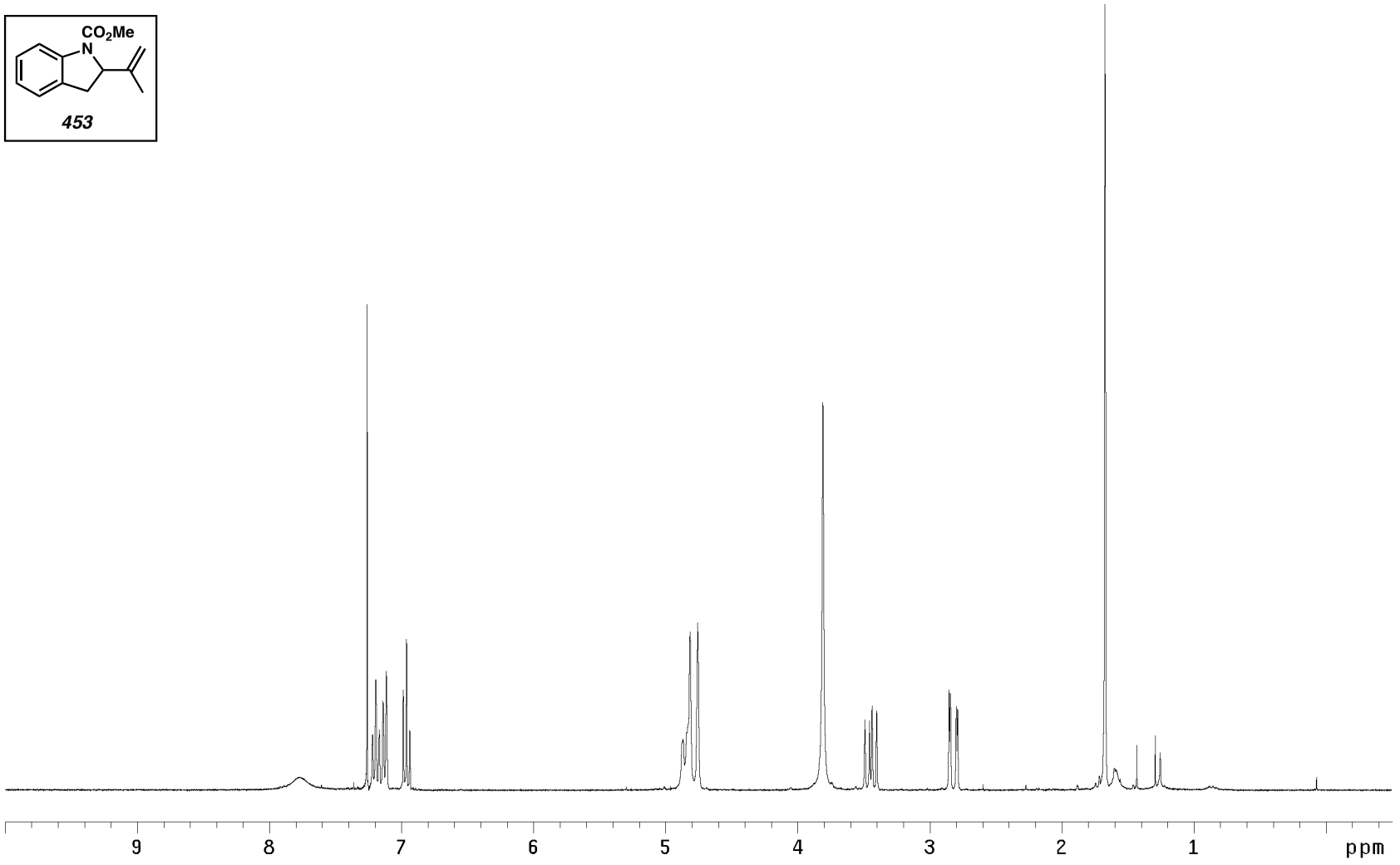


Figure A3.118 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **453**.

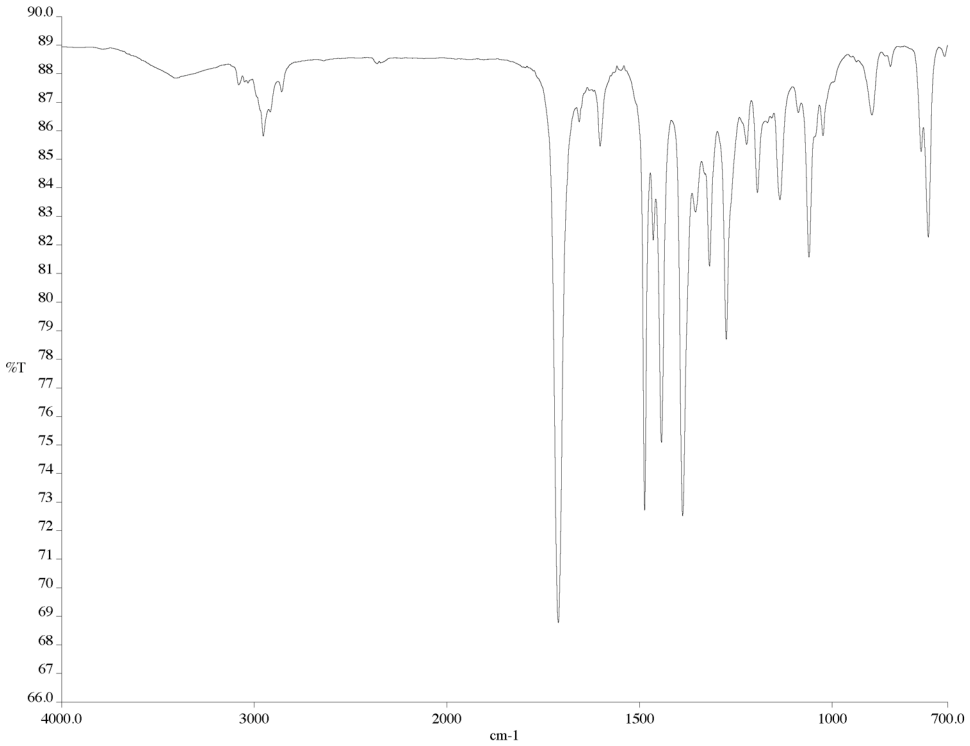


Figure A3.119 Infrared spectrum (thin film/NaCl) of compound **453**.

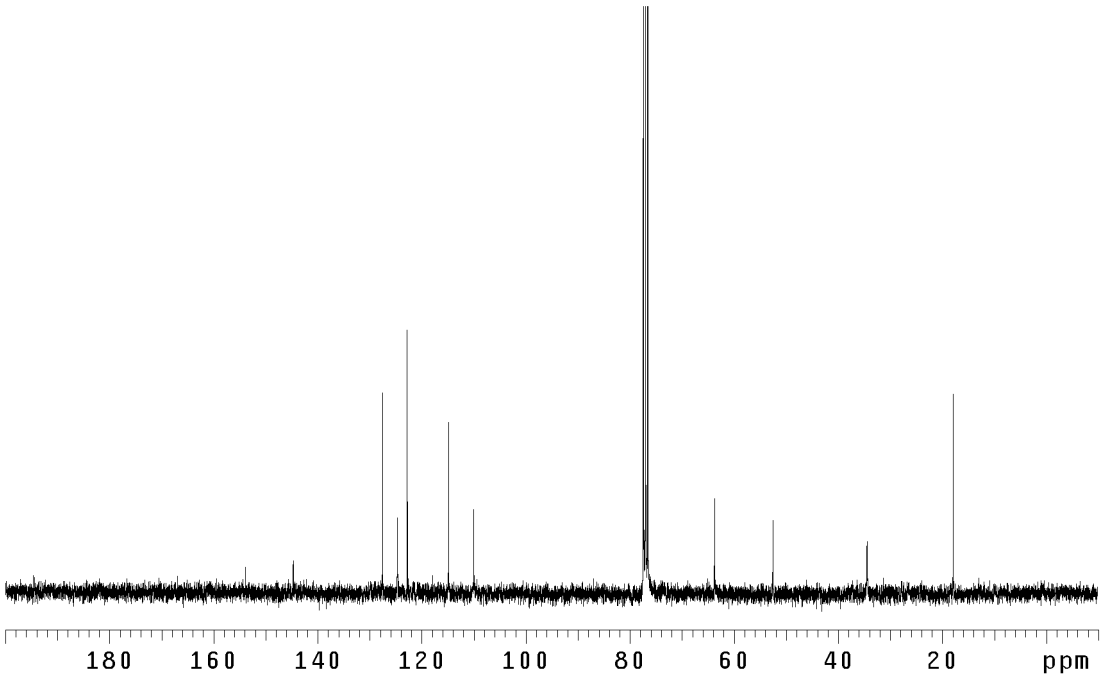


Figure A3.120 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **453**.

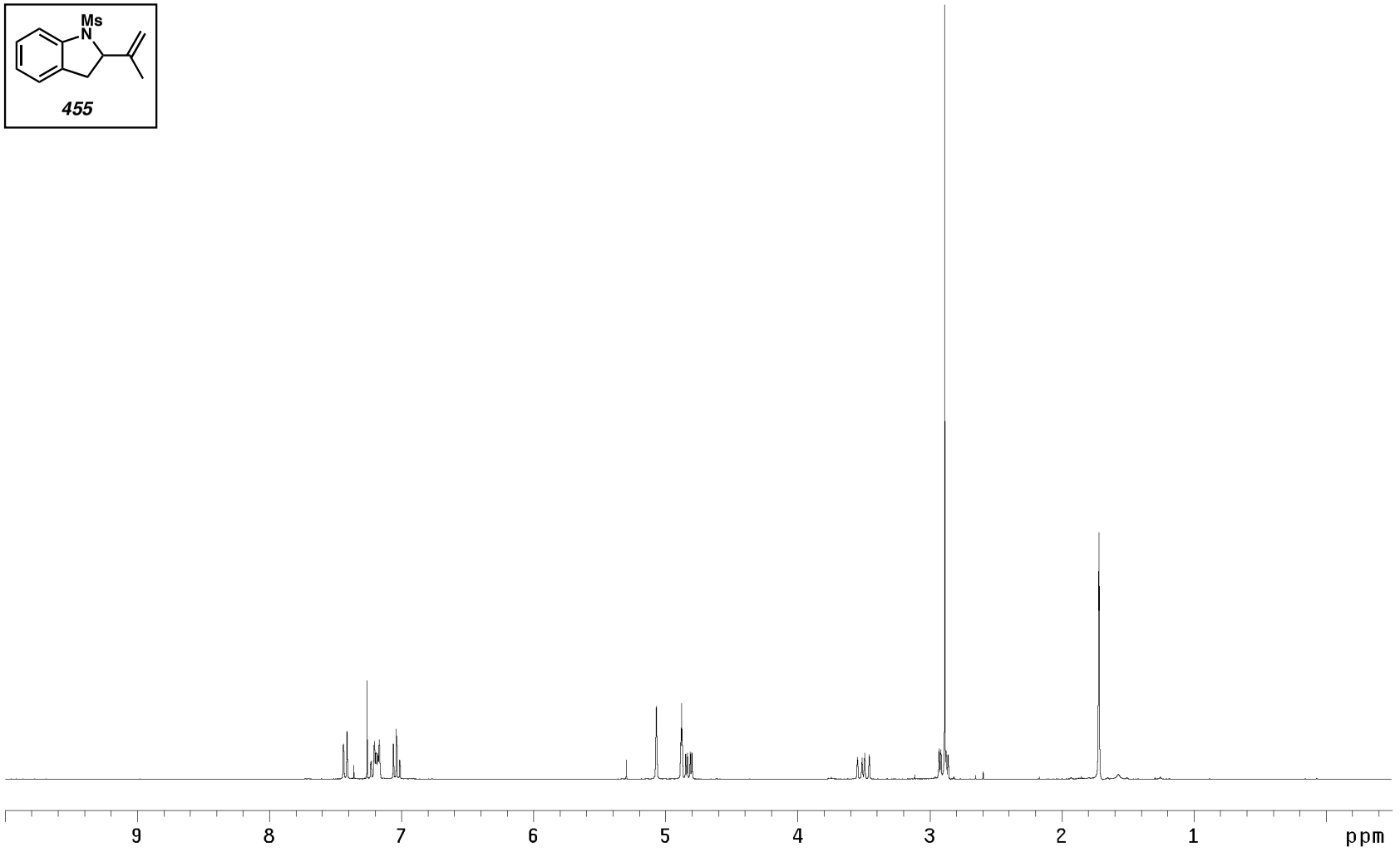


Figure A3.121 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **455**.

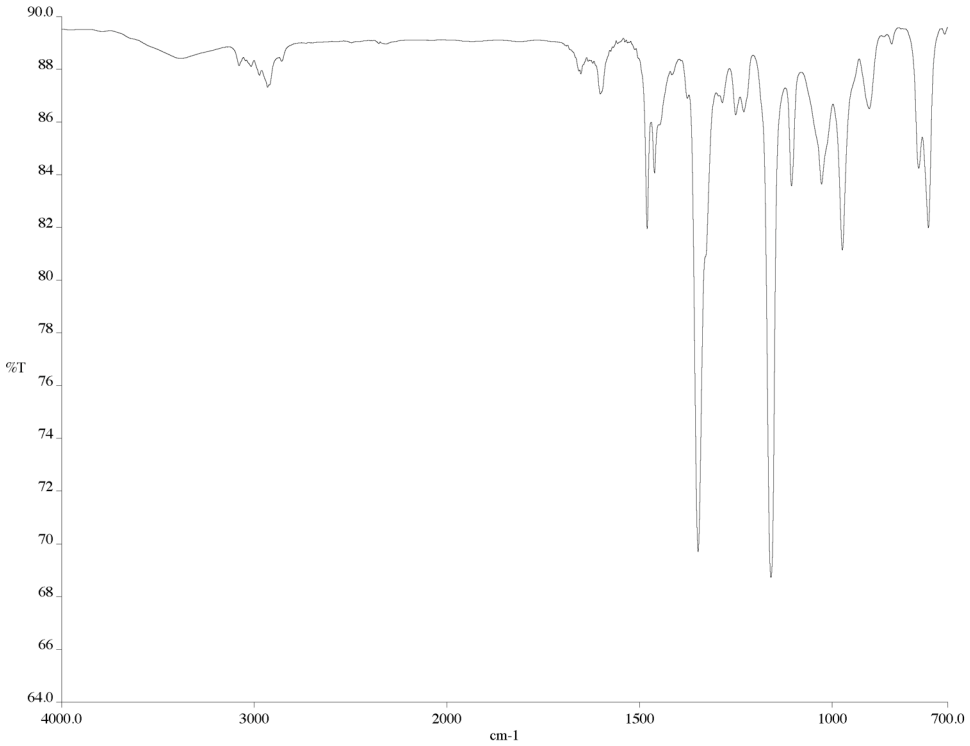


Figure A3.122 Infrared spectrum (thin film/NaCl) of compound **455**.

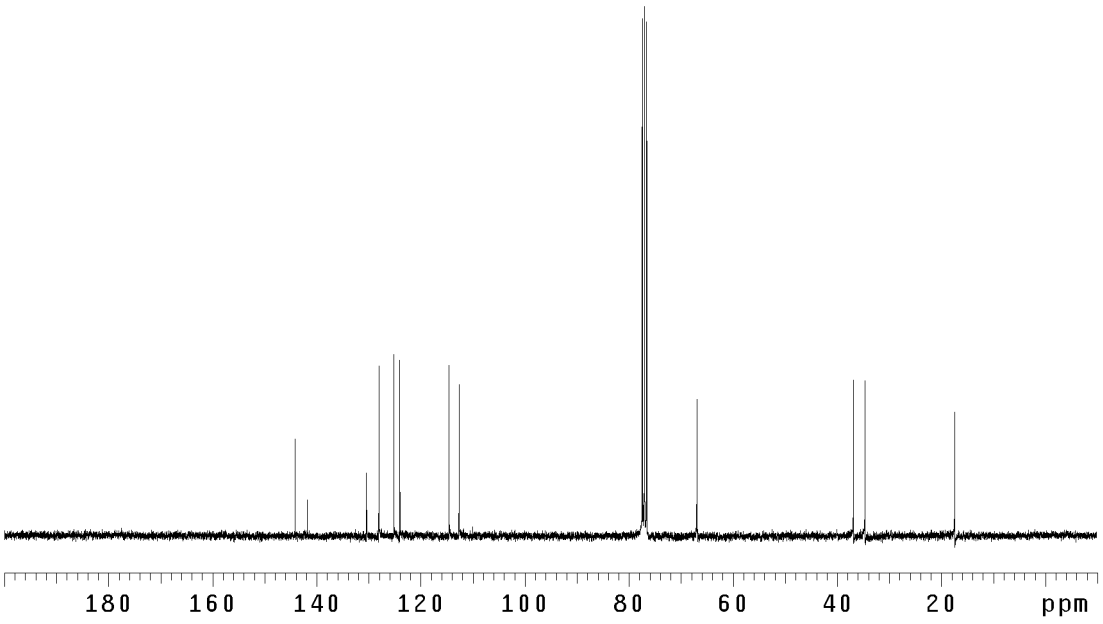


Figure A3.123 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **455**.

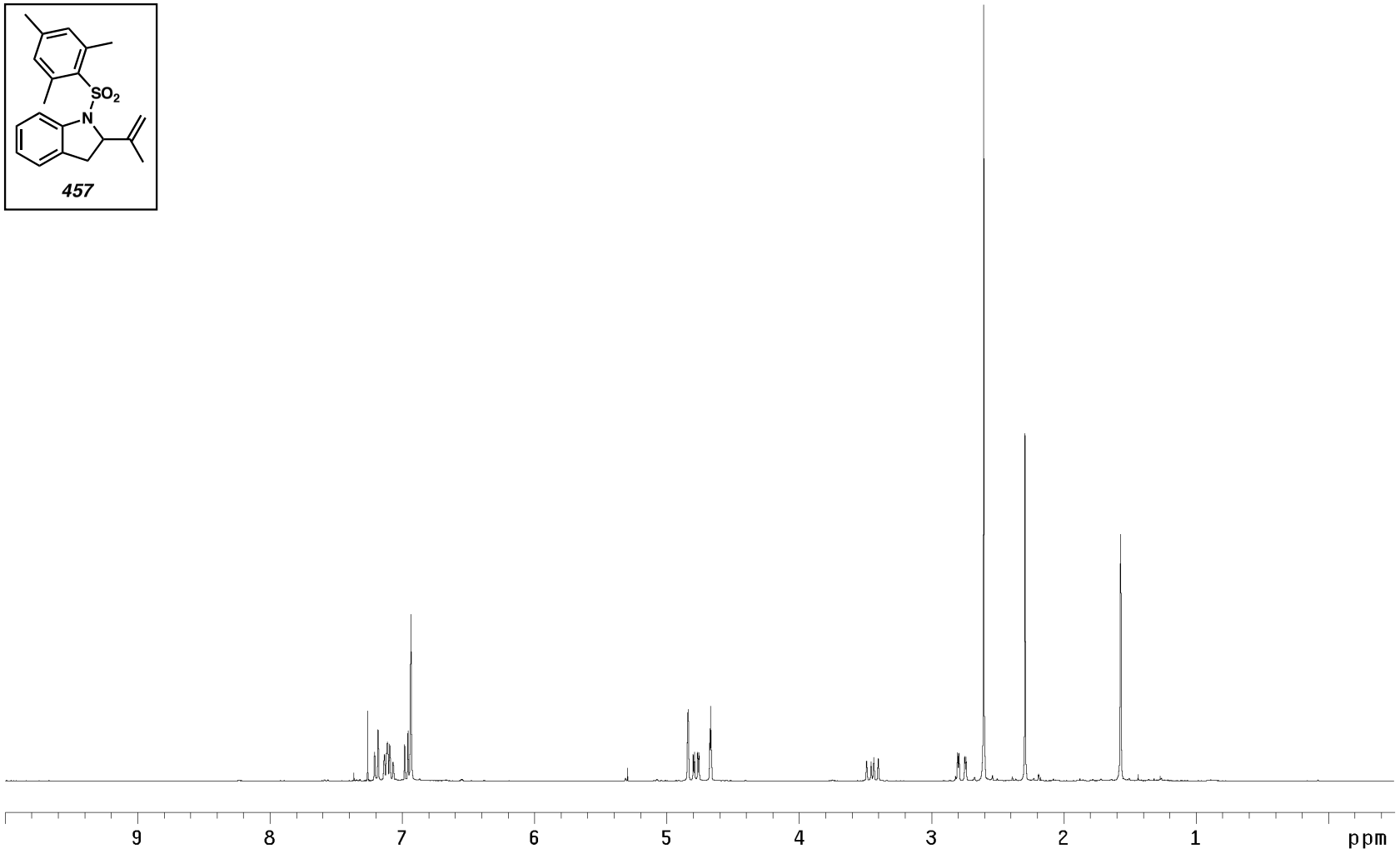


Figure A3.124 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **457**.

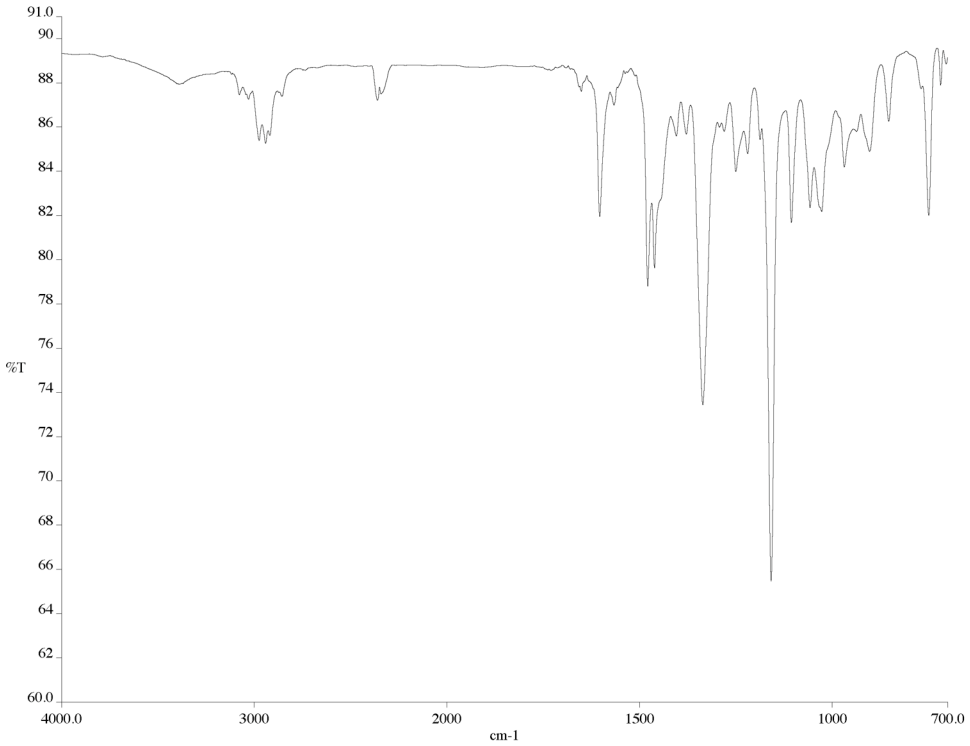


Figure A3.125 Infrared spectrum (thin film/NaCl) of compound **457**.

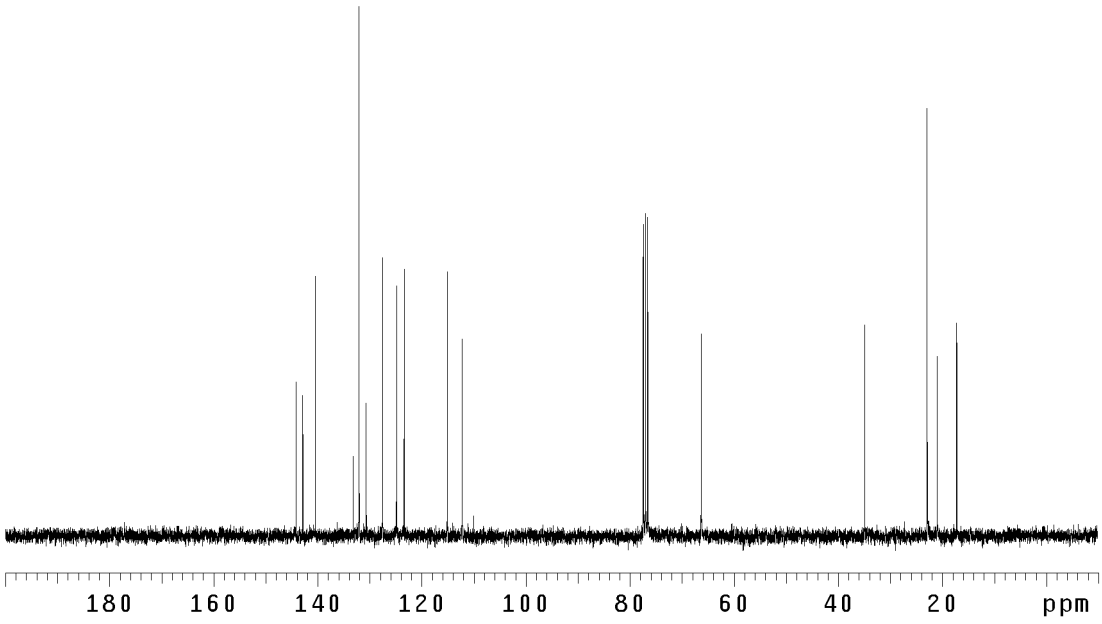


Figure A3.126 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **457**.

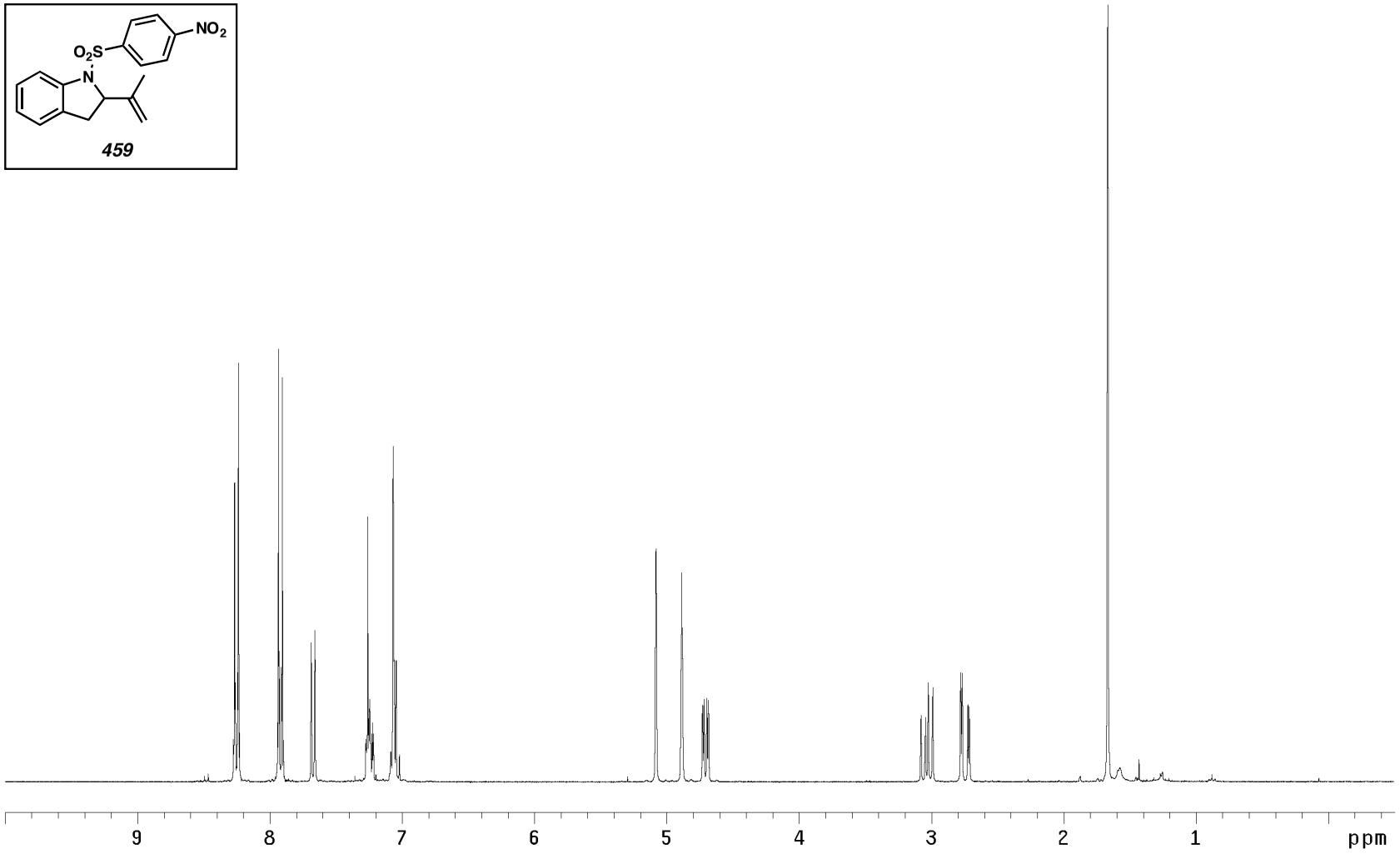


Figure A3.127 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **459**.

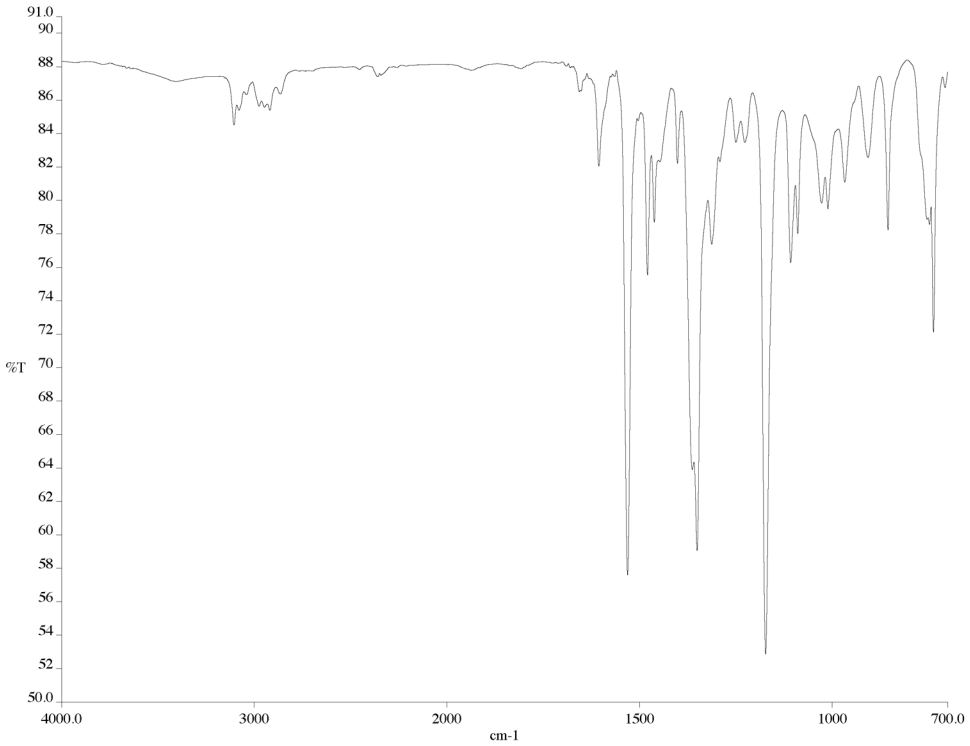


Figure A3.128 Infrared spectrum (thin film/NaCl) of compound **459**.

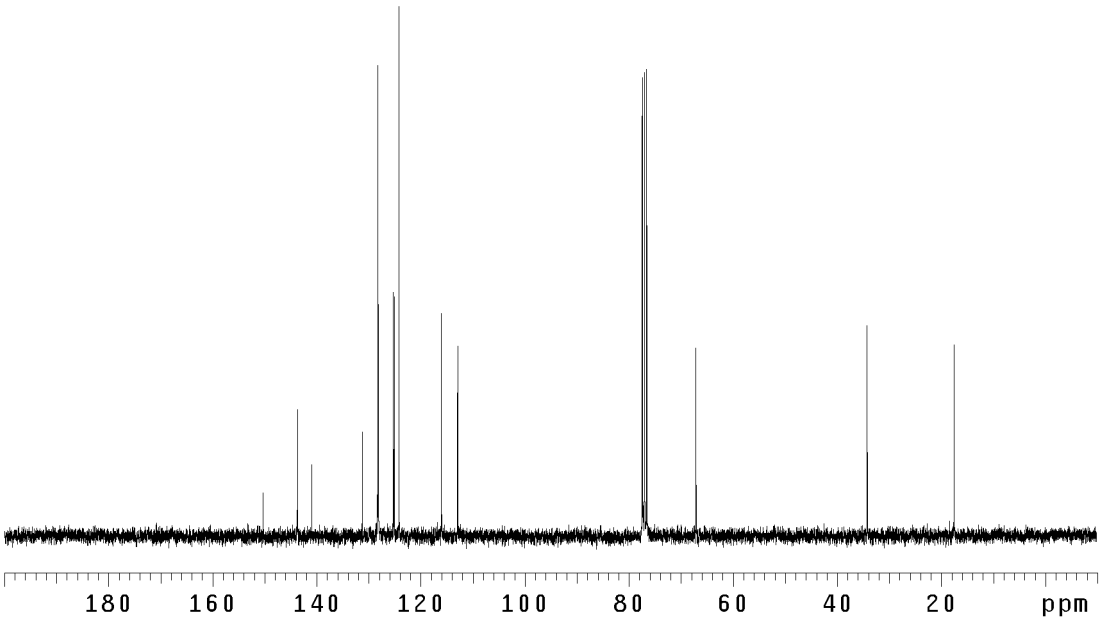


Figure A3.129 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **459**.

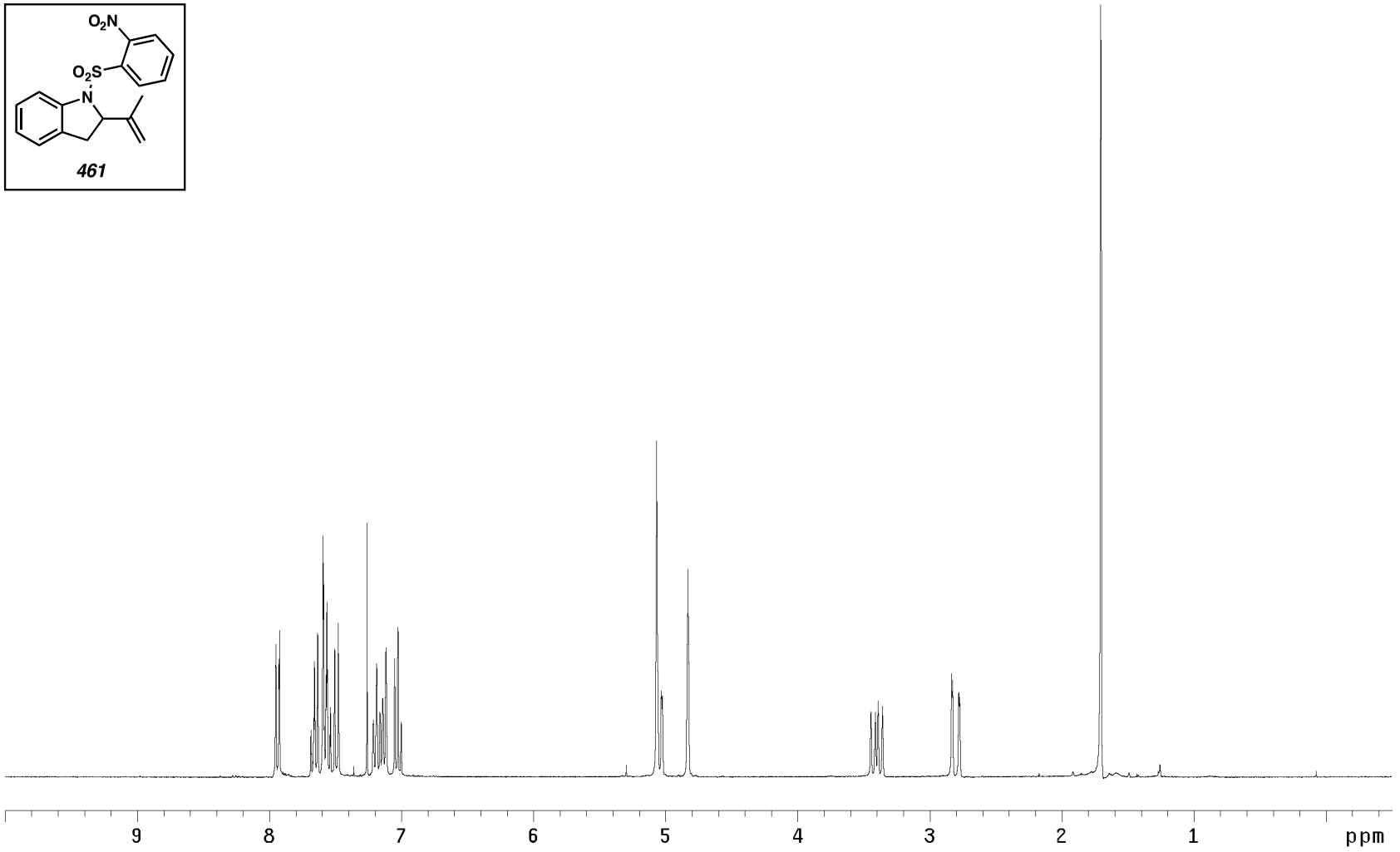


Figure A3.130 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **461**.

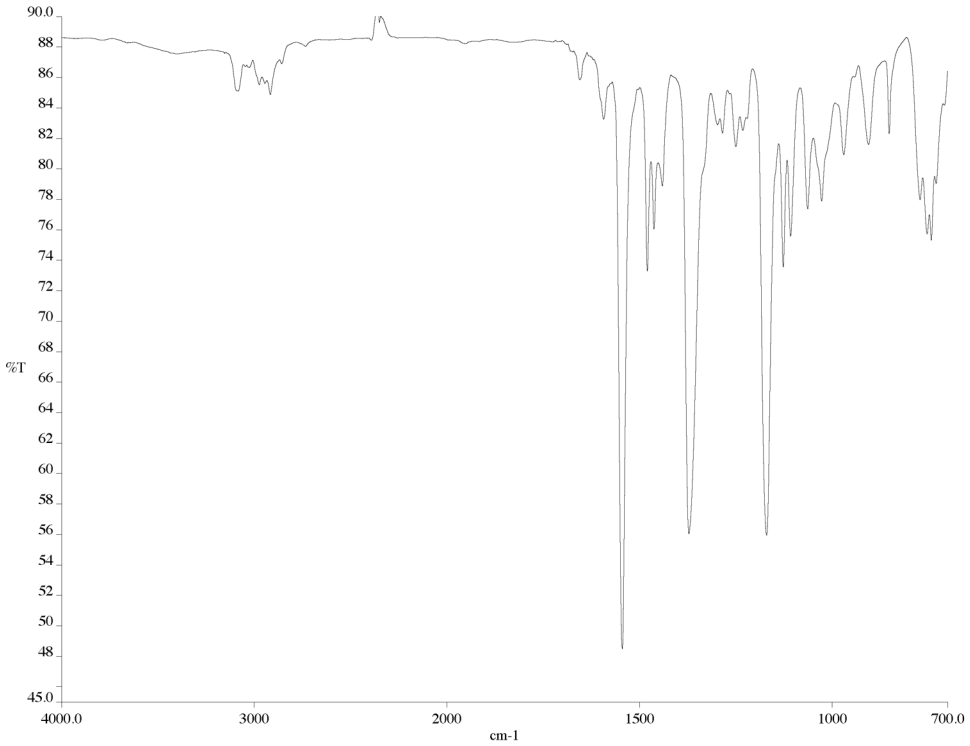


Figure A3.131 Infrared spectrum (thin film/NaCl) of compound **461**.

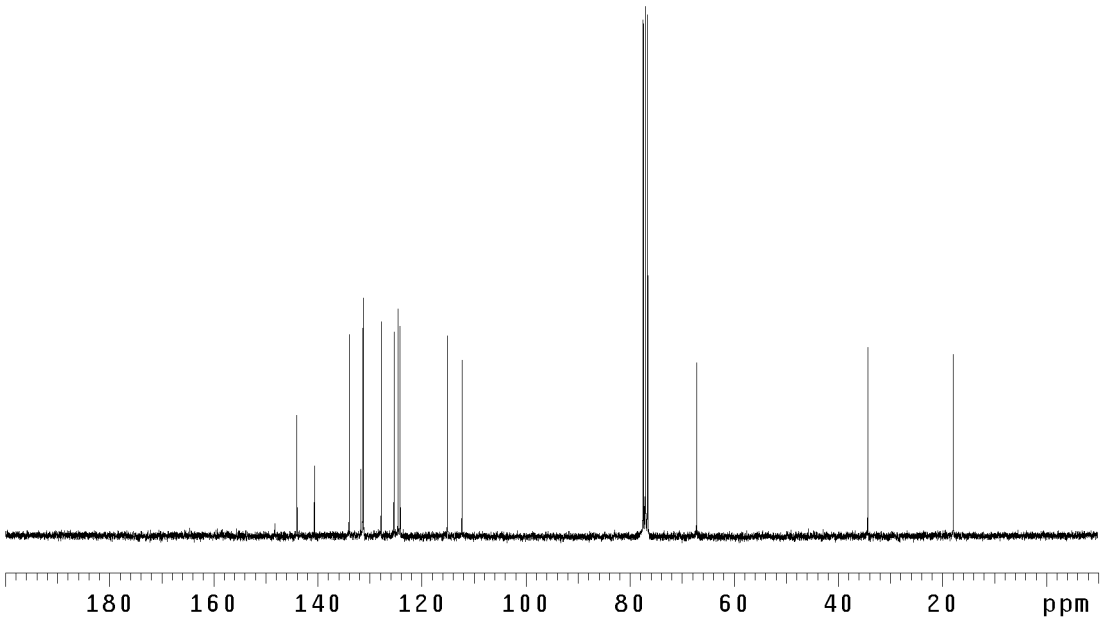


Figure A3.132 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **461**.

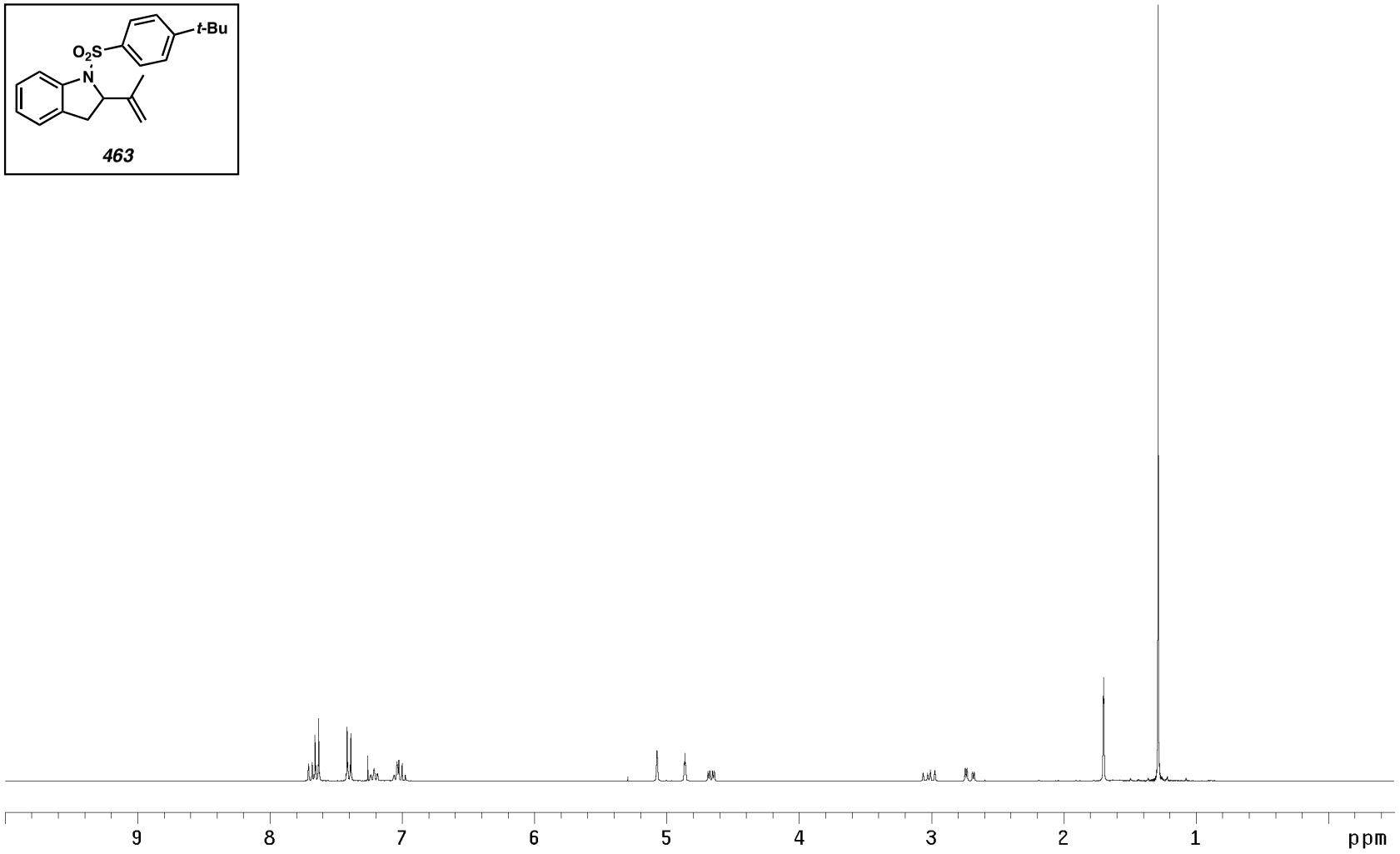


Figure A3.133 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **463**.

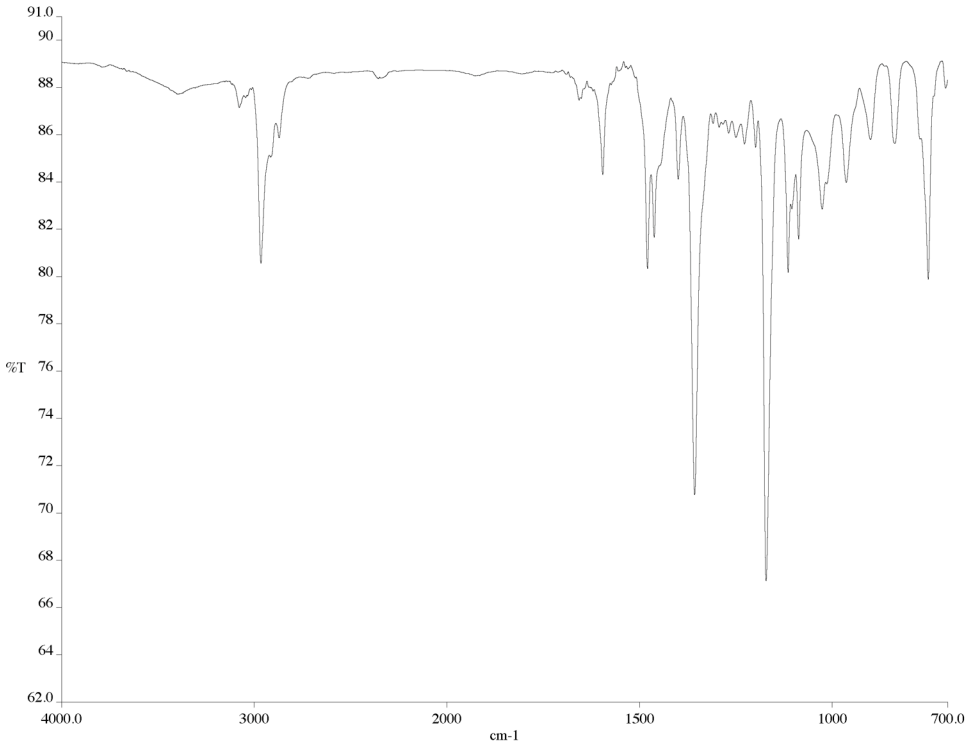


Figure A3.134 Infrared spectrum (thin film/NaCl) of compound **463**.

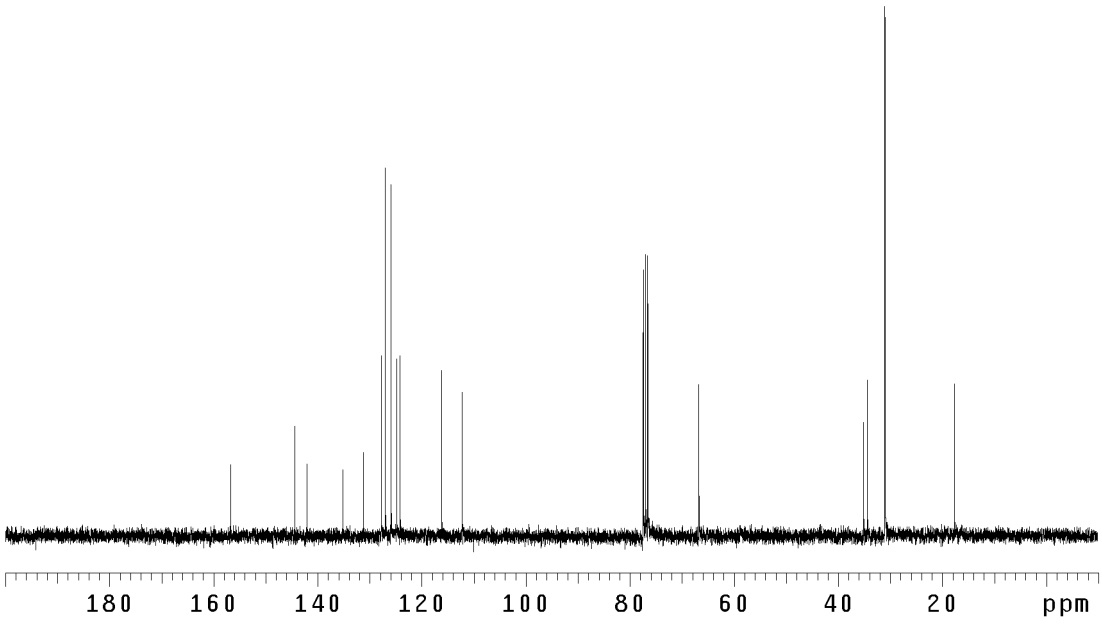


Figure A3.135 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **463**.

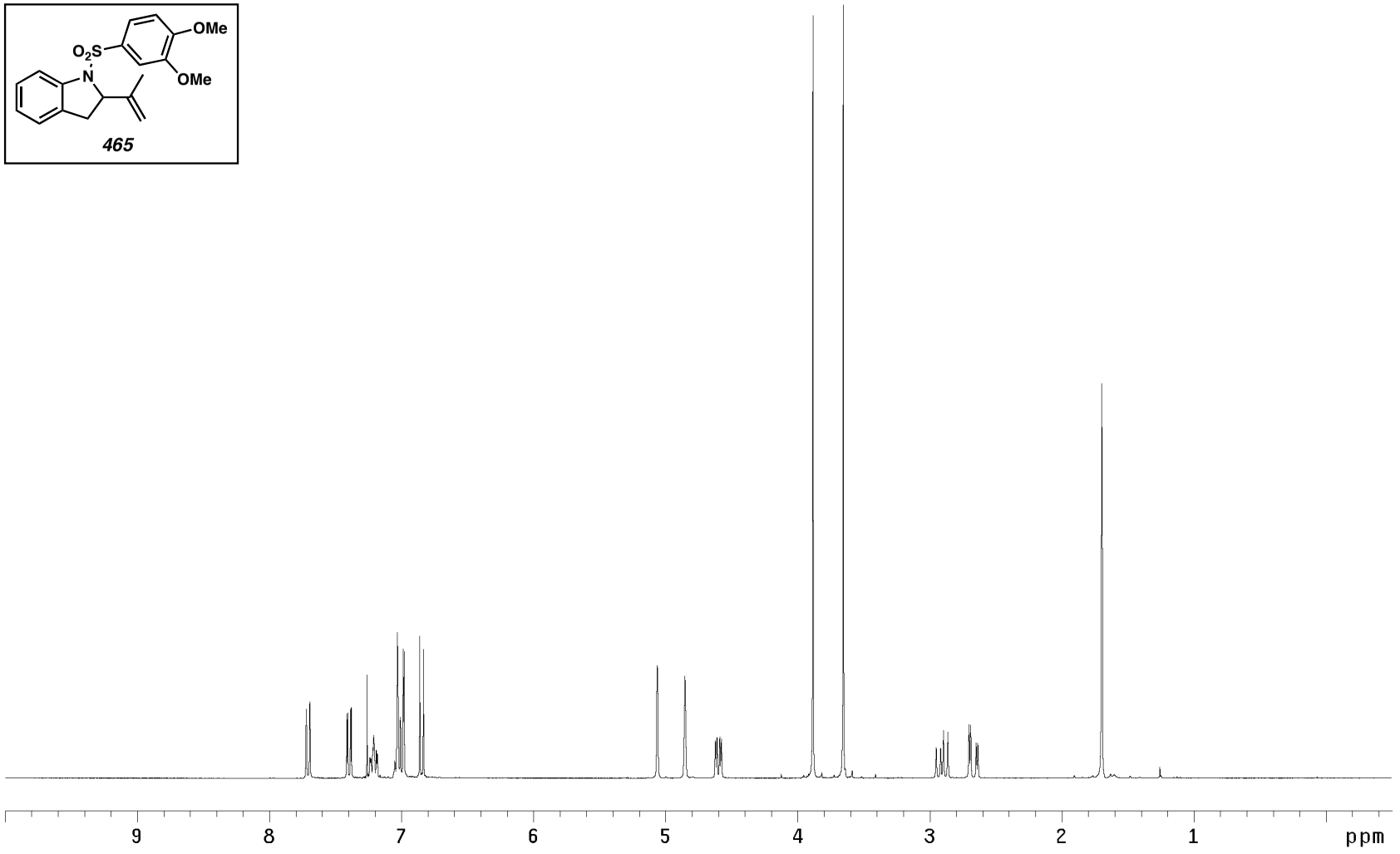


Figure A3.136 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **465**.

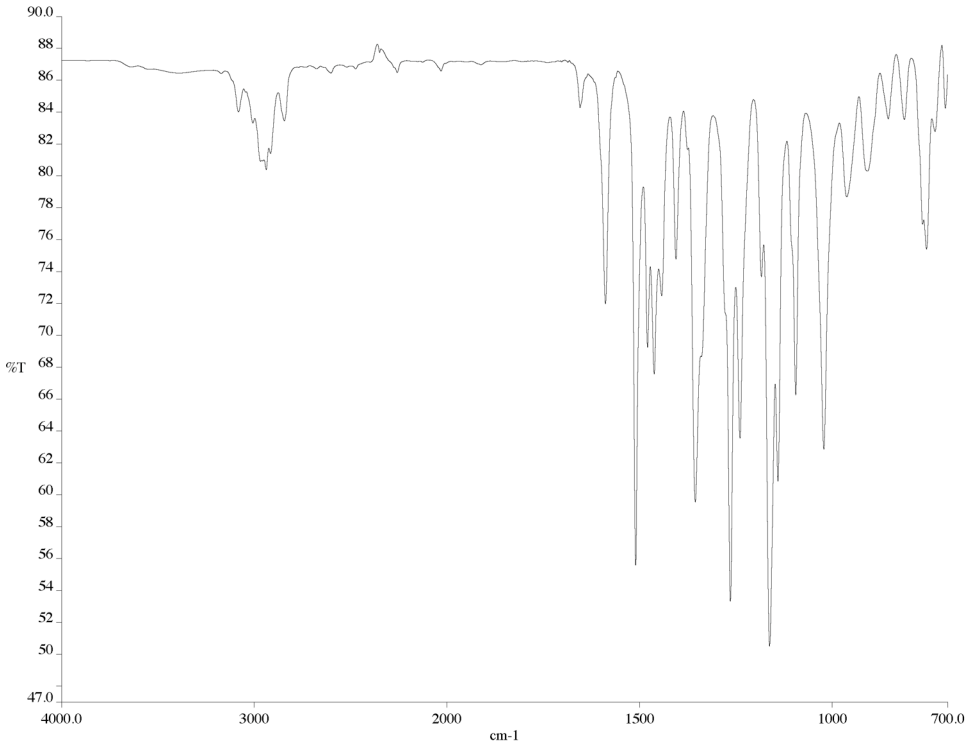


Figure A3.137 Infrared spectrum (thin film/NaCl) of compound **465**.

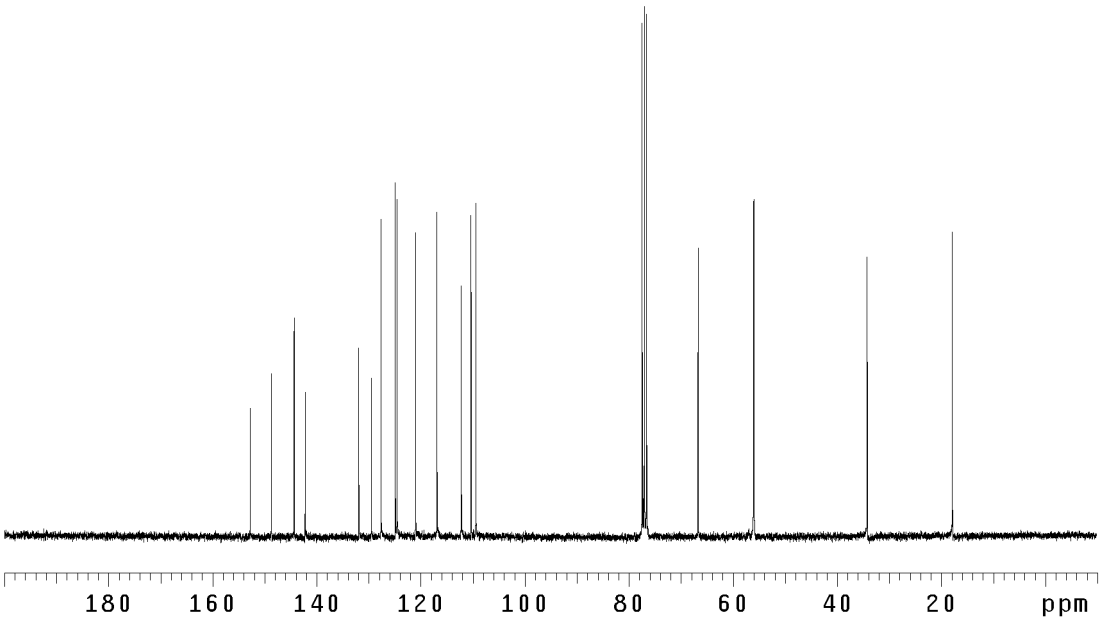


Figure A3.138 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **465**.

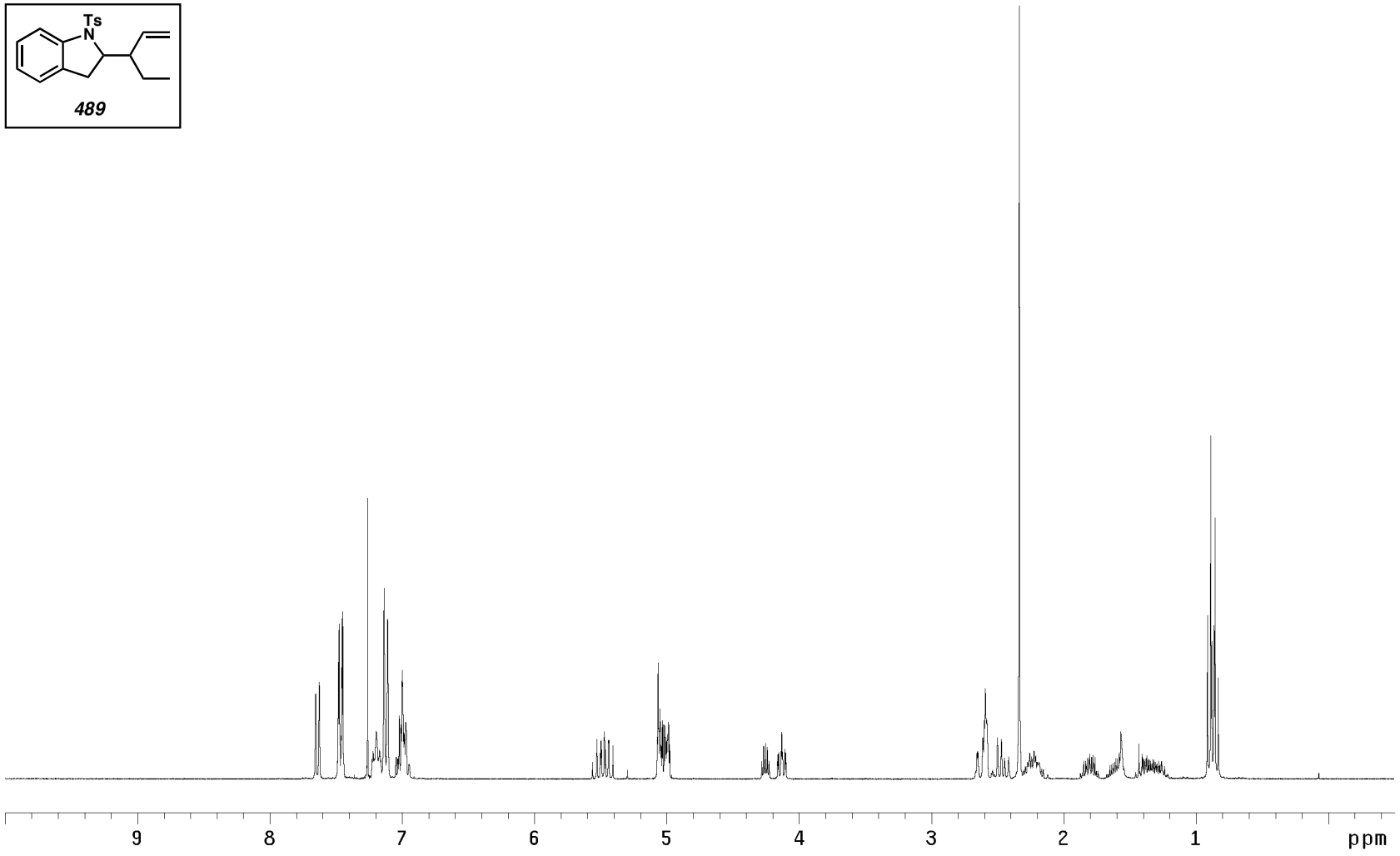


Figure A3.139 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **489**.

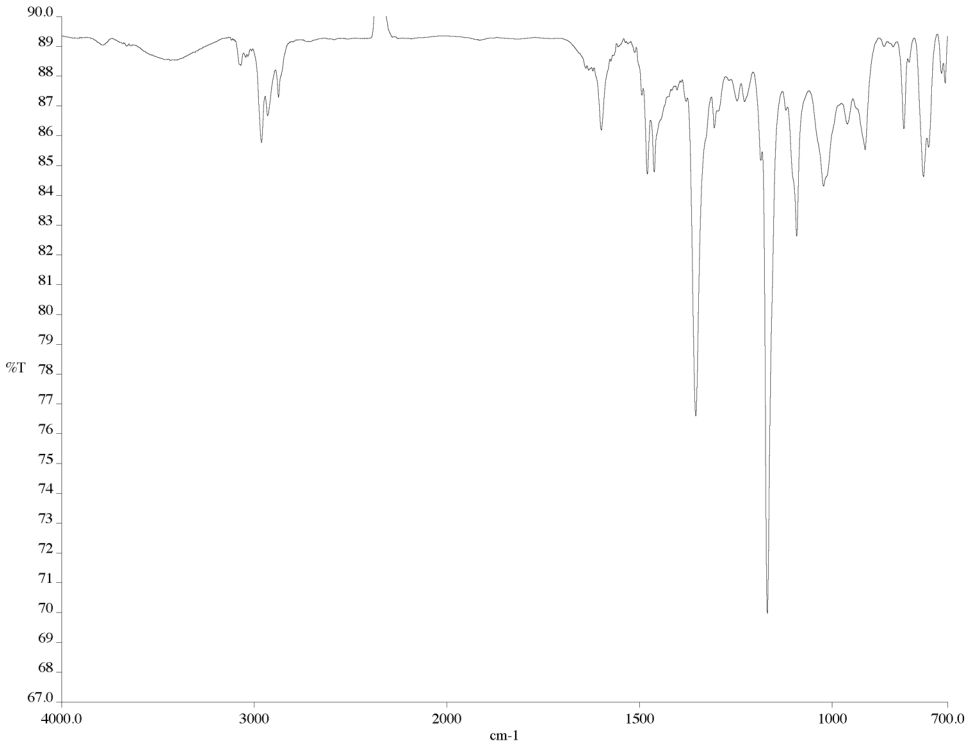


Figure A3.140 Infrared spectrum (thin film/NaCl) of compound **489**.

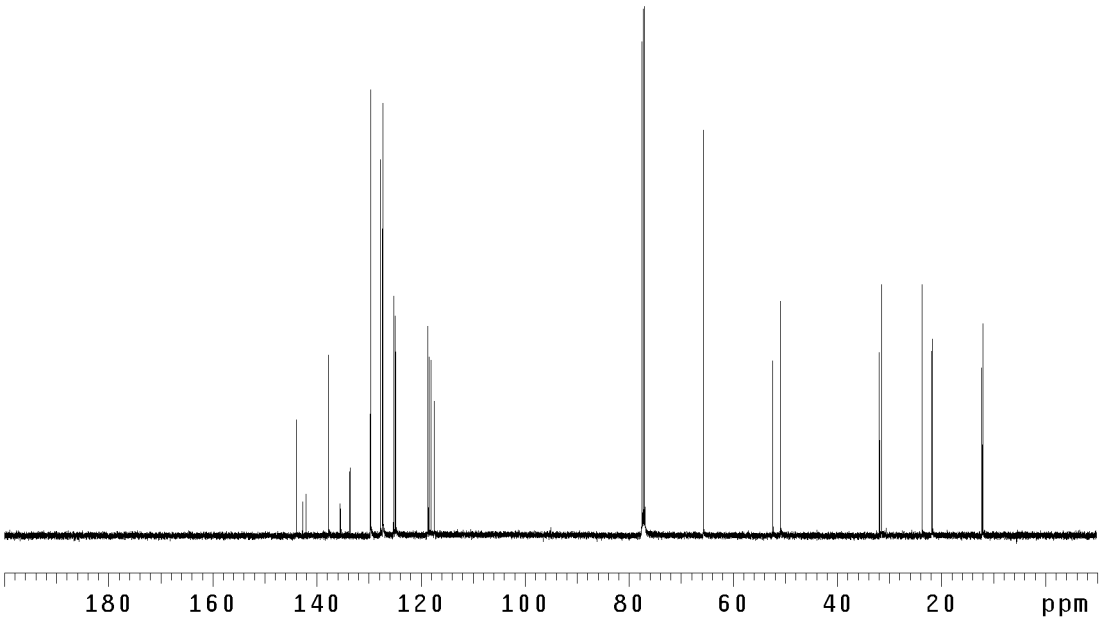


Figure A3.141 ^{13}C NMR (125 MHz, $CDCl_3$) of compound **489**.

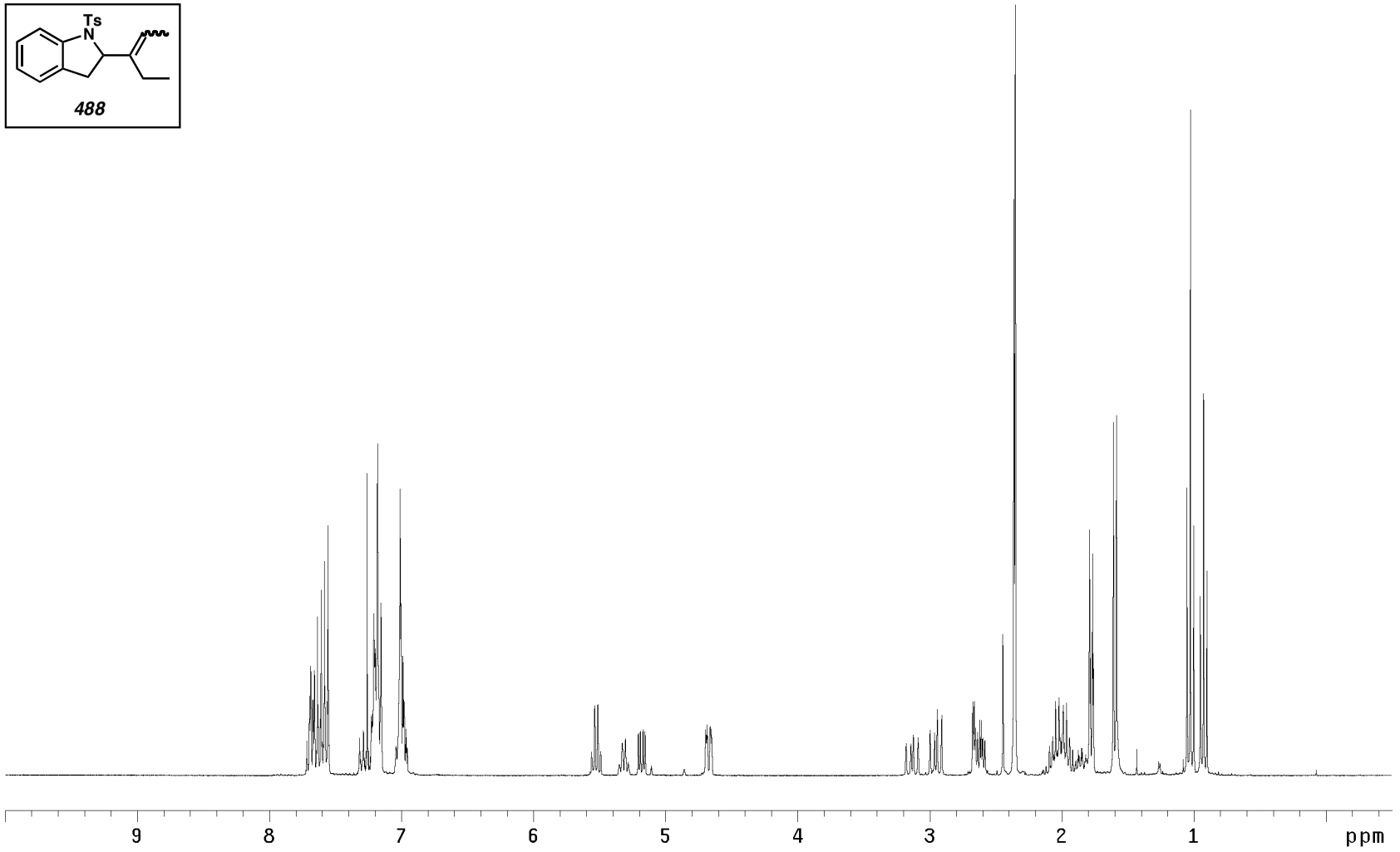


Figure A3.142 ^{1}H NMR (300 MHz, $CDCl_3$) of compound **488**.

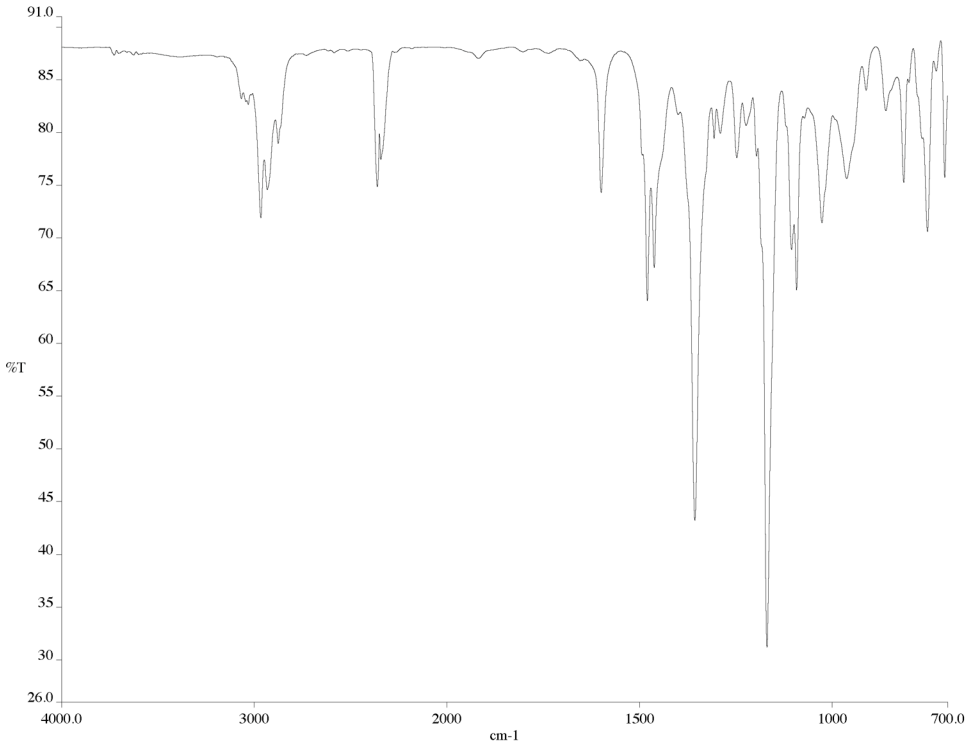


Figure A3.143 Infrared spectrum (thin film/NaCl) of compound **488**.

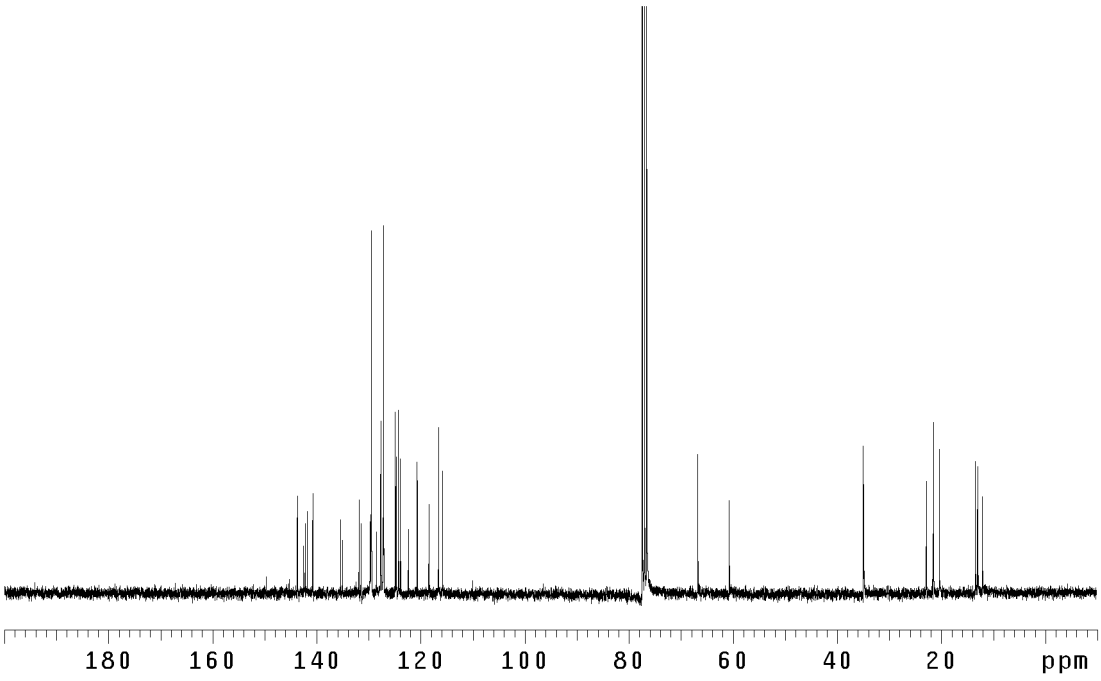


Figure A3.144 ^{13}C NMR (75 MHz, $CDCl_3$) of compound **488**.